PART D: SCIENCE BASE

Section 10: Major Conclusions

NUTRIENT ADEQUACY

Question 1: What Nutrients Are Most Likely to Be Consumed by the General Public in Amounts Low Enough To Be of Concern?

Conclusion

Reported dietary intakes of the following nutrients are low enough to be of concern:

- For adults: vitamins A, C, and E, calcium, magnesium, potassium, and fiber
- For children: vitamin E, calcium, magnesium, potassium, and fiber.

Efforts are warranted to promote increased dietary intakes of vitamin E, potassium, and fiber regardless of age; increased intakes of vitamins A and C, calcium, and magnesium by adults; and increased intakes of calcium and magnesium by children age 9 years or older. Efforts are especially warranted to improve the dietary intakes of adolescent females.

Question 2: What Dietary Pattern Is Associated With Achieving Recommended Nutrient Intakes?

Conclusion

Two major aspects of the USDA dietary pattern contribute to meeting nutrient intake recommendations:

1. Consumption of foods from each of the basic food groups:
   - fruits
   - vegetables
   - grains
   - milk, yogurt, and cheese
   - meat, poultry, fish, dry beans, eggs, and nuts[1]

2. Consumption of a variety of food commodities within each of those food groups—since higher energy intake is strongly associated with greater variety and higher nutrient intake, attention also should be given to food group choices that maintain appropriate energy balance.

Question 3: What Factors Related to Diet or Physical Activity May Help or Hinder Achieving Recommended Nutrient Intakes

Conclusion

[1] Some patterns designed to meet nutrient intake recommendations divide this group into two groups: (1) meat, poultry, and fish and (2) seeds, dry peas and beans, and nuts.

A sedentary lifestyle limits the amount of calories needed to maintain one's weight. Careful food selection is needed to meet recommended nutrient intakes within this calorie limit. Diets that include foods with a high nutrient content relative to calories are helpful in achieving recommended nutrient intakes without excess calories. Diets that include a large proportion of foods or beverages that are high in calories but low in nutrients are unlikely to meet recommended intakes for micronutrients and fiber, especially for sedentary individuals.

Question 4: How Can the Flexibility of Food Patterns Be Increased?

Conclusion

By careful planning that considers the relative nutrient content of different foods, substitutions can be made to a food intake pattern to achieve recommended nutrient intakes.

Question 5: Are Special Nutrient Recommendations Needed for Certain Subgroups?

Conclusion

Special nutrient recommendations are warranted for the following subgroups and nutrients:

- Adolescent females and women of childbearing age—iron and folic acid
- Persons over age 50—vitamin B_{12}
- The elderly, persons with dark skin and persons exposed to insufficient UVB radiation—vitamin D

A conclusion specific to each group and nutrient can be found in Part D, Section 1, Question 5.

ENERGY

Question 1: How Is Physical Activity Related to Body Weight and Other Nutrition-Related Aspects of Health?

Conclusion

Regular physical activity is essential to the maintenance of a healthy weight and reduces risk for the development of a number of chronic diseases. At least 30 minutes of moderate physical activity on most days provides important health benefits in adults. More than 30 minutes of moderate to vigorous physical activity on most days provides added health benefits. Many adults may need up to 60 minutes of moderate to vigorous physical activity on most days to prevent unhealthy weight gain.

Vigorous physical activity (e.g., jogging or other aerobic exercise) provides greater benefits for physical fitness than does moderate physical activity and burns calories more rapidly per unit of time.

Exercise that loads the skeleton has potential to reduce the risk of osteoporosis by increasing peak bone mass during growth, maintaining peak bone mass during adulthood, and reducing the rate of bone loss during aging.

Resistance exercise training increases muscular strength and endurance and maintains or increases lean body weight. These benefits are seen in adolescents, adults, and older adults who perform 8 to 10 resistance exercises 2 or more days per week.

Children and adolescents need at least 60 minutes of moderate to vigorous physical activity on most days for maintenance of good health and fitness and for healthy weight during growth. Reducing sedentary behaviors, including television- and video-viewing time, appears to be an effective way to treat and prevent overweight among children and adolescents.

Question 2: How Much Physical Activity Is Needed To Avoid Weight Regain in Weight-Reduced Persons?

Conclusion

Although the contribution of physical activity to weight loss usually is modest, acquiring a routine of regular physical activity will help an adult to maintain a stable body weight after successful weight loss. The amount of physical activity that weight-reduced adults need to avoid weight regain is estimated to be from 60 to 90 minutes daily at moderate intensity.

Question 3: What Are the Optimal Proportions of Dietary Fat and Carbohydrate to Maintain BMI and To Achieve Long-Term Weight Loss?

Conclusion

Weight maintenance depends on a balance of energy intake and energy expenditure, regardless of the proportions of fat, carbohydrate, and protein in the diet. Weight loss occurs when energy intake is less than energy expenditure, also regardless of the proportions of fat, carbohydrate, and protein in the diet. For adults, well-planned weight-loss diets that are consistent with the Accepted Macronutrient Distribution Ranges (IOM, 2002) for fat, carbohydrate, and protein can be safe and efficacious over the long term. The recommended ranges for fat calories (20 to 35 percent of total calories), carbohydrate calories (45 to 65 percent of total calories), and protein calories (10 to 35 percent of total calories) provide sufficient flexibility to accommodate weight maintenance for a wide variety of body sizes and food preferences.

Question 4: What Is the Relationship Between the Consumption of Energy Dense Foods and BMI?

Conclusion

Available data are insufficient to determine the contribution of energy dense foods to unhealthy weight gain and obesity. However, consuming energy dense meals may

contribute to excessive caloric intake. Conversely, eating foods of low energy density may be a helpful strategy to reduce energy intake when trying to maintain or lose weight.

Question 5: What Is the Relationship Between Portion Size and Energy Intake?

Conclusion

The amount of food offered to a person influences how much he or she eats; and, in general, more calories are consumed when a large portion is served rather than a small one. Thus, steps are warranted for consumers to limit the portion size they take or serve to others, especially for foods that are energy dense.

FATS

Question 1: What Are the Relationships Between Total Fat Intake and Health?

Conclusion

At low intakes of fat (< 20 percent of energy) and high intakes of carbohydrates (>65 percent of energy), risk increases for inadequate intakes of vitamin E, α linolenic acid, and linoleic acid and for adverse changes in high-density lipoprotein (HDL) cholesterol and triglycerides. At high intakes of fat (> 35 percent of energy), the risk increases for obesity and coronary heart disease (CHD). This is because fat intakes that exceed 35 percent of energy are associated with both increased calorie and saturated fat intakes. Total fat intake of 20 to 35 percent of calories is recommended for adults and 25 to 35 percent for children age 4 to 18 years. A fat intake of 30 to 35 percent of calories is recommended for children age 2 to 3 years.

Question 2: What Are the Relationships Between Saturated Fat Intake and Health?

Conclusion

The relationship between saturated fat intake and low-density lipoprotein (LDL) cholesterol is direct and progressive, increasing the risk of cardiovascular disease (CVD). Thus, saturated fat consumption by adults should be as low as possible while consuming a diet that provides 20 to 35 percent calories from fat and meets recommendations for α linolenic acid and linoleic acid. In particular,

- For adults with LDL cholesterol below 130 mg/dL, less than 10 percent of calories from saturated fatty acids is recommended.
- For adults with an elevated LDL cholesterol (≥ 130 mg/dL), less than 7 percent of calories from saturated fatty acids is recommended.[2]

[2] For persons with known heart disease, medical advice and the use of ATP III Panel Guidelines are indicated.

Question 3: What Are the Relationships Between *Trans* Fat Intake and Health?

Conclusion

The relationship between *trans* fatty acid intake and LDL cholesterol is direct and progressive, increasing the risk of CHD. *Trans* fatty acid consumption by all population groups should be kept as low as possible, which is about 1 percent of energy intake or less.

Question 4: What Is the Relationships Between Cholesterol Intake and CVD?

Conclusion

The relationship between cholesterol intake and LDL cholesterol concentrations is direct and progressive, increasing the risk of CHD. Thus, cholesterol intake should be kept as low as possible within a nutritionally adequate diet. In particular,

- For adults with an LDL cholesterol < 130 mg/dL, less than 300 mg of dietary cholesterol per day is recommended.
- For adults with an elevated LDL cholesterol (≥130 mg/dL), less than 200 mg of dietary cholesterol per day is recommended.

Question 5: What Are the Relationships Between n-6 PUFA Intake and Health?

Conclusion

An n-6 PUFA intake between 5 to 10 percent of energy may confer beneficial effects on coronary artery disease mortality.

Question 6: What Are the Relationships Between n-3 Fatty Acid Intake and Health?

Conclusion

An α-linolenic acid intake between 0.6 to 1.2 percent of calories will meet requirements for this fatty acid and may afford some protection against CVD outcomes.

The consumption of two servings per week of fish high in eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) is associated with reduced risk of both sudden death and CHD death in adults. To benefit from the potential cardioprotective effects of EPA and DHA, the weekly consumption of two servings (approximately 8 ounces) of fish, particularly fish rich in EPA and DHA is suggested. Other sources of EPA and DHA may provide similar benefits; however, further research is warranted.

Question 7: What Are the Relationships Between MUFA Intake and Health?

Conclusion

There is an inverse relationship between the intake of monounsaturated fatty acids (MUFAs) and the total cholesterol (TC):HDL cholesterol concentration ratio. If equal amounts of MUFAs are substituted for saturated fatty acids, LDL cholesterol decreases.

CARBOHYDRATES

Question 1: What Is the Relationship Between Intake of Carbohydrates and Dental Caries?

Conclusion

The intake of carbohydrates (including sucrose, glucose, fructose, lactose, and starch) contributes to dental caries by providing substrate for bacterial fermentation in the mouth. Drinking fluoridated water and/or using fluoride-containing dental hygiene products help reduce the risk of dental caries. A combined approach of reducing the frequency and duration of exposure to fermentable carbohydrates and optimizing oral hygiene practices is the most effective way to reduce caries incidence.

Question 2: How Important to Human Health Is the Glycemic Response to Carbohydrates?

Conclusion

A potential health concern for foods that raise blood glucose levels and initiate an insulin response is that they may eventually lead to diabetes. Current evidence suggests that there is no relationship between total carbohydrate intake (minus fiber) and the incidence of either type 1 or type 2 diabetes. The intake of fiber-containing foods is associated with a decreased risk of type 2 diabetes in a number of epidemiological studies.

Question 3: What Is the Utility of the Glycemic Index/Glycemic Load for Providing Dietary Guidance for Americans?

Conclusion

Current evidence suggests that glycemic index and/or glycemic load are of little utility for providing dietary guidance for Americans.

Question 4: What Is the Significance of Added Sugars Intake to Human Health?

Conclusion

Compared with individuals who consume small amounts of foods and beverages that are high in added sugars, those who consume large amounts tend to consume more calories but smaller amounts of micronutrients. Although more research is needed, available prospective studies suggest a positive association between the consumption of sugar-sweetened beverages and weight gain. A reduced intake of added sugars (especially sugar-sweetened beverages) may be helpful in achieving recommended intakes of nutrients and in weight control.

Question 5: What Are the Major Health Benefits of Fiber-Containing Foods?

Conclusion

Diets rich in dietary fiber have a number of important health benefits including helping to promote healthy laxation, reducing the risk of type 2 diabetes, and decreasing the risk of CHD. Prospective cohort studies suggest that decreased risk of heart disease is associated with the intake of 14 g of dietary fiber per 1,000 calories.

FOOD GROUPS

Question 1: What Are the Relationships Between Fruit and Vegetable Intake and Health?

Conclusion

Greater consumption of fruits and vegetables (5 to 13 servings or 2 ½ to 6 ½ cups per day depending on calorie needs[3]) is associated with a reduced risk of stroke and perhaps other CVDs, with a reduced risk of cancers in certain sites (oral cavity and pharynx, larynx, lung, esophagus, stomach, and colon-rectum), and with a reduced risk of type 2 diabetes (vegetables more than fruit). Moreover, increased consumption of fruits and vegetables may be a useful component of programs designed to achieve and sustain weight loss.

Question 2: What Are the Relationships Between Whole-Grain Intake and Health?

Conclusion

Consuming at least 3 servings (approximately equivalent to 3 ounces) of whole grains per day can reduce the risk of diabetes and CHD and help with weight maintenance. Thus, daily intake of three or more servings of whole grains per day is recommended, preferably by substituting whole grains for refined grains.

Question 3: What Are the Relationships Between Milk Product Intake and Health?

Conclusion

Consuming three servings (equivalent to 3 cups) per day of milk and milk products each day can reduce the risk of low bone mass and contribute important amounts of many nutrients. Furthermore, this amount of milk product consumption may have additional health benefits and is not associated with increased body weight. Therefore, the intake of three servings of milk products per day is recommended.

FLUIDS AND ELECTROLYTES

[3] See Tables D1-13 and D1-16 for information on 2 to 3 year olds.

Question 1: What Amount of Fluid Is Recommended for Health?

Conclusion

The combination of thirst and usual drinking behavior, especially the consumption of fluids with meals, is sufficient to maintain normal hydration. Healthy individuals who have routine access to fluids and who are not exposed to heat stress consume adequate water to meet their needs. Purposeful drinking is warranted for individuals who are exposed to heat stress or who perform sustained vigorous activity.

Question 2: What Are the Effects of Salt (Sodium Chloride) Intake on Health?

Conclusion

The relationship between salt (sodium chloride) intake and blood pressure is direct and progressive without an apparent threshold. Hence, individuals should reduce their salt intake as much as possible. In view of the currently high levels of salt intake, a daily sodium intake of less than 2,300 mg is recommended. Many persons will benefit from further reductions in salt intake, including hypertensive individuals, blacks, and middle- and older-aged adults. Individuals should concurrently increase their consumption of potassium because a diet rich in potassium blunts the effects of salt on blood pressure.

Question 3: What Are the Effects of Potassium Intake on Health?

Conclusion

Diets rich in potassium can lower blood pressure and lessen the adverse effects of salt on blood pressure, may reduce the risk of developing kidney stones, and possibly decrease bone loss. In view of the health benefits of potassium and its relatively low intake by the general population, a daily potassium intake of at least 4,700 mg is recommended. Blacks are especially likely to benefit from an increased intake of potassium.

ETHANOL

Question 1: Among Persons Who Consume Four or Fewer Alcoholic Beverages Per Day, What Is the Dose-Response Relationship Between Alcohol Intake and Health?

Conclusion

1. In middle-aged and older adults, a daily intake of one to two alcoholic beverages is associated with the lowest all-cause mortality.
2. Compared with nondrinkers, adults who consume one to two alcoholic beverages per day appear to have lower risk of CHD.
3. Compared with nondrinkers, women who consume one alcoholic beverage per day appear to have a slightly higher risk of breast cancer.
4. Relationships of alcohol consumption with major causes of death do not differ for middle-aged and elderly Americans. Among younger people, however, alcohol

consumption appears to provide little, if any, health benefit; alcohol use among young adults is associated with a higher risk of traumatic injury and death.

Question 2: What Is the Relationship Between Consuming Four or Fewer Alcoholic Beverages Daily and Macronutrient Profiles, Micronutrient Profiles, and Overall Diet Quality?

Conclusion

A daily intake of one to two alcoholic beverages is not associated with inadequate intake of macronutrient or micronutrients, or with overall dietary quality.

FOOD SAFETY

Question 1: What Behaviors Are Most Likely To Prevent Food Safety Problems?

Conclusion

The behaviors in the home that are most likely to prevent a problem with foodborne illnesses are

- Cleaning hands, contact surfaces, and fruits and vegetables (but not meat and poultry, which should not be washed)
- Separating raw, cooked and ready-to-eat foods while shopping, preparing, or storing
- Cooking foods to a safe temperature
- Chilling (refrigerate) perishable foods promptly

Question 2: What Topics, If Any, Need Attention Even Though They Are Not an Integral Part of the "FightBAC!" Campaign?

Conclusion

Avoiding higher-risk foods is an important protective measure (e.g., deli meats and frankfurters that have not been reheated to a safe temperature may contain *Listeria*). This is especially important for high-risk groups (the very young, pregnant women, elderly and those who are immunocompromised).