Dietary Guidelines Advisory Committee Meeting 5

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Meeting Summary

Tuesday, April 13, 2010 (9:00 a.m.)

Participants

Dietary Guidelines Advisory Committee: Dr. Linda V. Van Horn (Chair), Dr. Naomi K. Fukagawa (Vice-Chair), Dr. Cheryl Achterberg, Dr. Lawrence J. Appel, Dr. Roger A. Clemens, Dr. Miriam E. Nelson, Dr. Sharon M. Nickols-Richardson, Dr. Thomas A. Pearson, Dr. Rafael Pérez-Escamilla, Dr. Xavier Pi-Sunyer, Dr. Eric B. Rimm, Dr. Joanne L. Slavin, Dr. Christine L. Williams

Executive Secretaries: Ms. Carole Davis, Ms. Kathryn McMurry

Others: Dr. Robert Post, RADM Penelope Slade-Sawyer, Dr. Wendy Braund

Welcome and Opening Remarks

Dr. Robert Post, Deputy Director of the Center for Nutrition Policy and Promotion (HHS), called the meeting to order at 9:00 a.m. on Dr. Anand's behalf. He thanked the Committee members and recognized the continued cooperation between USDA and HHS. All Committee members attended via Webinar. He reviewed the Committee's charge: to inform the Secretaries of USDA and HHS of warranted changes to the *Dietary Guidelines* that are based on review of scientific and medical evidence published since the last *Dietary Guidelines*, emphasizing food-based recommendations over nutrient-based recommendations. The DGAC will not translate recommendations into policy or communications documents. The Committee will submit an advisory report of technical recommendations and the recommendations' rationales to the Secretaries. Dr. Post reviewed information from the Federal Advisory Committee Act (FACA), including the requirements to publish announcements of each meeting in a *Federal Register* notice in support of open, transparent meetings. To further support transparency, members are not to hold discussions with members of the public or outside groups but are to refer them to Dietary Guidelines Management Team for information. The public was invited to provide written comments and can review archived recording of the meetings at www.dietaryguidelines.gov. Transcripts and meeting summaries will be posted when available.

Rear Admiral Penny Slade Sawyer, Deputy Assistant Secretary for Health, Disease Prevention and Health Promotion (HHS), expressed HHS' appreciation for the Committee's

work, expertise, and commitment to public service. HHS looks forward to receiving the report and using it to develop official policy, in partnership with USDA.

Dr. Robert Post commented on the success of using WebEx and informed the internet audience on how to get technical assistance. He turned the meeting over to Dr. Van Horn.

Dr. Linda V. Van Horn, (DGAC Chair), greeted the meeting attendees. The Committee and staff have been working to complete the proposed conclusion statements and supporting summaries of the evidence on the remaining research questions and are working on draft chapters. The focus of this fifth meeting was to come to consensus on the science for these research questions and to consider the integration of the conclusions and food-based recommendations. At the sixth public meeting, the Committee will come to consensus on the advisory report and discuss remaining issues. In addition to seven topic area Subcommittees, the Committee has a Science Review Subcommittee that provides guidance and oversight on the technical review of the evidence. The Subcommittees are working jointly to develop a Total Diet chapter and a Translation and Integration chapter.

The evidence reviewed at this meeting will also be available to the public in the USDA Nutrition Evidence Library (NEL), ensuring that the details of the science review are well-documented, transparent, and reproducible. The NEL process reduces reviewer bias and standardizes the approach across the Subcommittees. Dr. Van Horn gave general information on how the scientific literature was searched, sorted, and reviewed. She touched on inclusion and exclusion criteria, preferred types of studies, and grading of the evidence. The conclusions of the studies take into account the quality of the studies, the consistency of the finding, the number of studies supporting the evidence, magnitude of the effect or outcome, and generalizability. Based on these criteria, the conclusions are graded: I, strong; II, moderate; III, limited; IV, expert opinion; and V, grade not assignable. For some questions, food pattern modeling was used to understand implications of specific recommendations on the total diet. For others, data analyses were used. Only conclusions for which there was a NEL review are graded.

Before calling the first Subcommittee, Dr. Van Horn explained that the Subcommittees would present their research questions, propose conclusion statements, and briefly describe supporting evidence. She noted that the Subcommittees conducted extensive reviews of the literature and graded the evidence before drafting their conclusions. She reminded the public that everything being presented was still in draft form.

Carbohydrates and Protein Subcommittee
Chair, Joanne Slavin, Ph.D., R.D.

Joanne Slavin, Chair of the Subcommittee, acknowledged the Subcommittee members and staff. The Subcommittee addressed the following two protein and seven carbohydrate questions: the relationship between animal protein products and selected health outcomes; the relationship between vegetable protein and/or soy protein and selected health outcomes; the health benefits of dietary fiber; the relationship between whole grain intake and selected health outcomes; the associations between intake of sugar-sweetened beverages and energy intake and body weight; how non-caloric sweeteners are related to body weight, the impact of liquids versus solid foods

on energy intake and body weight; the role of carbohydrates, fiber, protein, fat, and food form on satiety; and the role of prebiotics and probiotics and health.

The animal and vegetable protein questions were not addressed by the *2005 Dietary Guidelines*. The 2010 Carbohydrates and Protein Subcommittee looked at this topic using a NEL review from January 2000 to present. The first research question was, "What is the relationship between the intake of animal protein products (except milk and milk products and seafood, which were considered in separate reviews) and: colorectal, prostate, and breast cancer; type 2 diabetes; cardiovascular disease; hypertension; and body weight?" Based on the evidence, the draft overall conclusion was, "Most studies find no association with intake of animal protein products and risk of disease, including cardiovascular disease (Grade II), blood pressure and hypertension (Grade II), type 2 diabetes (Grade III), and body weight (Grade III). Animal protein intake seems to be related to some cancers (including colorectal cancer [Grade II] and premenopausal breast cancer [Grade III]) but this relationship varies by cancer type and possibly differences in preparation or cooking methods (e.g., prostate cancer and processed or well done meat [Grade III])."

For animal products and colorectal cancer, the draft conclusion was, "Inconsistent positive associations have been reported between colorectal cancer and the intake of certain animal protein products, mainly red and processed meat. (Grade II)" The 13 studies looked at different kinds of meats in different ways. No consistent findings were reported.

For animal proteins and prostate cancer, the draft conclusion was, "There is little evidence from prospective cohort studies that animal protein products are associated with prostate cancer incidence. (Grade III)" This conclusion was based on the review of six articles, all of positive quality, representing six prospective cohorts in the United States. The studies consistently reported no association between total, red, processed, or white meat consumption, meat-cooking method and risk of total prostate cancer, incidences of cancer, or advanced disease. Individual studies found some risk with processed, very well done, and total meat consumption, but other studies reported no association with these types of meat.

For risk of breast cancer, the draft conclusion was, "Cohort studies show little association between intake of animal protein products and overall breast cancer risk, although animal protein intake may alter risk for certain types of breast cancer. (Grade III)" This conclusion was based on the review of six articles (five of positive and one of neutral quality) representing cohorts from the United States and United Kingdom.

For type 2 diabetes (T2D), the draft conclusion was, "Prospective cohort studies suggest that intake of animal protein products, mainly processed meat, may have a link to type 2 diabetes although results are not consistent. (Grade III)" This conclusion was based on seven articles (five of positive and two of neutral quality) representing prospective cohorts from the United States.

The draft conclusion for cardiovascular disease was: "Prospective cohort studies show little relationship between the intake of animal protein products and cardiovascular diseases. (Grade II)" The evidence reviewed was seven articles with prospective cohorts from the US and Japan.

For blood pressure, the draft conclusion was, "No clear association was found between intake of animal protein products and blood pressure in prospective cohort studies. (Grade II)" The studies reviewed included six prospective cohorts from the US, UK, and Spain. Though some studies showed positive associations between certain types of meat and blood pressure, the findings were not consistent.

For body weight, the draft conclusion was, "Existing research finds little link between meat intake and body weight. (Grade III)" This review consisted of three articles: one randomized controlled trial (RCT), one prospective cohort and one cross-sectional study. Links were made between certain types of meat and weight, but the findings were not consistent. The implications for animal protein products were that proteins found in animal sources such as meat, poultry, fish, eggs, milk, cheese, and yogurt provide all nine indispensable amino acids and are referred to as "complete proteins." When protein needs are high, in pregnancy, lactation, and childhood, complete proteins are important components of the diet. If animal products are not consumed, complementary proteins are important. It is possible to get protein from plants, but those avoiding animal products will need to combine the amino acids when protein needs are high.

Dr. Slavin moved on to vegetable protein. The Subcommittee considered the following questions: "What is the relationship between the intake of vegetable protein, including soy protein, and chronic disease?" "What is the relationship between the intake of vegetable protein and blood pressure?" and "What is the relationship between the intake of soy protein and blood pressure, body weight and blood lipids?" The overall draft conclusion was, "Little evidence exists that supports unique health benefits of vegetable protein, including soy protein, on measurable health outcomes. Few studies are available, and the limited data collectively suggests, that vegetable protein does not offer special protection against type 2 diabetes, coronary heart disease, and selected cancers (Grade III). Intake of vegetable protein is generally linked to lower blood pressure in both cohort and cross-sectional studies (Grade II), and some data suggest soy protein may lower blood pressure in adults with normal blood pressure (Grade III). Soy protein had no advantage over other proteins when consumed in an isocaloric study on body weight (Grade II). Soy protein may have small effects on total and LDL cholesterol in adults with normal or elevated blood lipids, although results from systematic reviews are inconsistent. (Grade II)"

For chronic disease, the draft conclusion was, "Few studies are available, and the limited data collectively suggests that vegetable protein does not offer special protection against type 2 diabetes, coronary heart disease, and selected cancers. (Grade III)" This conclusion was based on the review of seven studies (six prospective cohort studies and one ecological study), all published since 2000. Five studies focused on vegetable protein, two on soy protein. Five of the seven studies were of neutral quality and overall, they showed no consistent relationships.

For blood pressure, the draft conclusion was, "Intake of vegetable protein is generally linked to lower blood pressure in both cohort and cross-sectional studies. (Grade II)" The review was of six studies, four prospective observational and two cross-sectional, all published since 2000. Reduction in blood pressure was consistent across the studies.

For soy protein and blood pressure, the Subcommittee's draft conclusion was, "Some data suggests soy protein may lower blood pressure in adults with normal blood pressure. (Grade III)" The Subcommittee reviewed five studies (three RCTs, one prospective cohort study, and one cross-sectional study). Although there were negative associations between soy protein and elevated blood pressure, the studies were of differing types and the results were not consistent.

For soy protein and body weight, the draft conclusion was, "Soy protein had no advantage over other proteins when consumed in an isocaloric study on body weight. (Grade II)" Four articles (one systematic review, one RCT, one crossover trial, and one cross-sectional study) were reviewed. The studies were isocaloric, so there was no difference in body weight.

The question of soy protein and blood lipids had the draft conclusion, "Soy protein may have small effects on total and LDL cholesterol in adults with normal or elevated blood lipids, although results from systematic reviews are inconsistent. (Grade II)" The review consisted of six articles (four systematic reviews, one RCT, and one cross-sectional study) published since 2000. According to the systematic reviews, it took high doses of soy protein to produce an effect.

For vegetable protein overall, there were a number of implications. Recommended levels of dietary protein from both animal and plant sources must be consumed to achieve optimal nutrition intake. Intake of vegetable protein was generally linked to lower blood pressure levels in both cohort and cross-sectional studies, but this could be due to other nutrients in plant foods, such as fiber. Individual sources of vegetable protein have no apparent unique health benefits so choice of protein sources can come from a wide range of plant-based foods. Recommendations to lower calorie intake by increasing plant-based food intake must be linked to cautionary messages to maintain protein intakes at recommended levels.

Before moving on to the carbohydrate questions, Dr. Slavin opened the floor for discussion on the animal and vegetable protein topics. Dr. Rimm and others said, on the topic of meat and cancer, it seems the association is stronger than the conclusion indicates. For prostate cancer and diabetes, a number of the studies showed that processed or well cooked meats may be related. Perhaps there should be a recommendation that animal proteins come from sources that are not processed. Unfortunately, FDA does not adequately define "minimally processed." It is important to think of the total diet and not just nutrients in isolation. Although the research questions excluded dairy and focus on meat, the implications referred to animal-derived protein. Total protein and blood pressure is another issue to look at in the future. There was discussion on different types of studies. Meta-analyses can obscure the impact of landmark studies. In the cohort studies, protein was usually eaten instead of something else, usually carbohydrates. There was discussion of making the language of the conclusion better match the grading of the evidence and maintaining a balanced grading scale across the Subcommittees. Due to the lack of data on children, the conclusions addressed only adults.

Dr. Slavin moved on to the carbohydrate topics. The first question, "What are the health benefits of dietary fiber?" was investigated using a non-NEL review, since the American Dietetic Association (ADA) published a review in 2008. The draft conclusion was, "Dietary fiber from whole foods, including whole grains, protects against cardiovascular disease and obesity and is

essential for digestive health. Not all isolated fiber (functional fibers) have proven physiological effects and need to be evaluated in RCTs." This evidence was not graded.

The second carbohydrate question was, "What is the relationship between the intake of whole grains and incidence of cardiovascular disease, incidence of type 2 diabetes, and body weight or measures of adiposity?" This question was addressed by the 2005 *Guidelines*, so the NEL review looked at articles since 2004. The Subcommittee also excluded studies that only considered participants diagnosed with chronic disease. The draft overall conclusion was: "Whole grain intake, which includes cereal fiber, protects against cardiovascular disease. Whole grain intake is also associated with lower blood pressure. (Grade II) Evidence suggests that consumption of whole grains is associated with a reduced incidence of type 2 diabetes. The lack of randomized, controlled trials limits a stronger conclusion. (Grade III) Intake of whole grains and grain fiber is associated with lower body weight. (Grade III)"

The first subquestion was on whole grains and cardiovascular disease. The draft conclusion was, "Whole grain intake, which includes cereal fiber, protects against cardiovascular disease. Whole grain intake is associated with lower blood pressure in prospective cohort trials. Limited RCTs find little differences in surrogate cardiovascular disease (CVD) endpoints when whole grains are consumed. (Grade II)" This was based on seven articles (two systematic reviews, one meta-analysis, three prospective cohorts, and one RCT). In the articles on whole grains, there was no standard definition for whole grains or how to measure them, causing comparison problems.

For whole grains and type 2 diabetes, the Subcommittee's draft conclusion was, "Evidence from prospective cohort studies suggests that consumption of whole grains is associated with a reduced incidence of type 2 diabetes. The lack of randomized controlled trials limits a stronger conclusion. (Grade III)" The Subcommittee reviewed four articles (one systematic review with meta-analysis, one systematic review, one prospective cohort, and one RCT). While the other reviews showed an inverse association between whole grains and diabetes, the WHOLEheart study, the only RCT, showed no effect.

For the subquestion on body weight or adiposity, the draft conclusion was, "Intake of whole grains and grain fiber is associated with lower body weight, although few RCTs or prospective cohort studies are published in this area. (Grade III)" The evidence review included eight studies (one systematic review with meta-analysis, one systematic review, one non-randomized crossover trial, two randomized trials, and three cross-sectional studies).

The overall draft implications for whole grains were that grain fiber intake is a stronger predictor of health benefit than whole grain intake. This is likely due to the inability to define and measure whole grains. Evidence is strong that consumption of grain fiber is linked to less cardiovascular disease (CVD), T2D, and obesity, but evidence to support any unique benefits of whole grains is lacking. Results from the few RCTs published for whole grains showed few measurable health outcomes with whole grain interventions.

There was a brief discussion of the studies with Dr. Rimm and Dr. Slavin. Whole grain consumption is only likely to result in weight loss when the grains are replacing something else. They discussed whether or not to change the recommendation from, "consume half of grains as

whole grains" to "consume as large a proportion as possible". Fortified grains provide folic acid. A better definition on whole grains in needed. There was very little in the studies on teenagers. Dr. Slavin and Nickols-Richardson discussed linking grain fiber to other sources of fiber in the *Guidelines* and comparing cereal fiber intake to fruit and vegetable fiber intake.

Dr. Slavin moved to the next question. The 2005 DGAC looked at added sugar intake and health, finding that added sugar intake was linked to increased calorie intake, reduced micronutrient intake, and weight gain. For the update, the review strategy was to consider literature from 1990-present with subjects ages 19 yrs and older, since the childhood overweight section addressed sugar sweetened beverages. For the question, "In adults, what is the association between the intake of sugar-sweetened beverages and energy intake?" the draft conclusion was, "Little evidence that intake of added sugar, including sugar-sweetened beverages is linked to higher energy intake. (Grade II)" The second question, "In adults, what is the association between intake of sugar-sweetened beverages and body weight?" had the draft conclusion, "Limited evidence from epidemiologic studies and RCTs that added sugars, including sugar-sweetened beverages, are more likely to cause obesity than any other source of energy. (Grade II)" Dr. Slavin said the implications for added sugars were that measurement of "added sugars" in studies is inconsistent, making study comparisons difficult. It's easier to count sugar-sweetened beverages. Comparisons of sucrose, high fructose corn syrup, and milk show little difference in satiety and energy intake. Added sugar is not different from other extra calories for energy intake and body weight. The intent of the recommendation was to make people think about calories overall. However, Dr. Appel pointed out that studies have shown weight loss and loss maintenance from reduction of sugar-sweetened beverage intake alone.

Dr. Slavin spoke on the next carbohydrate question: "How are non-caloric sweeteners related to energy intake and body weight?" The review strategy was to consider the 2006 ADA Evidence Analysis Library review of non-nutritive sweeteners for children and adults and perform an NEL update. The draft conclusion was: "If non-caloric sweeteners are substituted for higher calorie food or beverages, they are associated with weight loss. Observational studies find that individuals who use non-caloric sweeteners are more likely to gain weight or be heavier. This does not support that non-caloric sweeteners cause weight gain, only that they are more likely to be used in overweight and obese individuals. (Grade II)" Dr. Slavin went over the ADA EAL conclusions for adults and children. For adults they said, "Using non-nutritive sweeteners (NNS) in either a calorie restricted or ad libitum diet will affect overall energy balance only if the non-nutritive sweeteners are substituted for higher calorie food and beverages. (Grade II)" For children and adolescents, "Studies do not support that the use of non-nutritive sweeteners causes weight gain. If non-caloric beverages, including NNS, are substituted for sugar-sweetened beverages, there is a potential for energy savings in adolescents. (Grade III)" The NEL update identified three additional articles on both energy intake and weight gain. The relationship between NNS and overweight may not be causal. There were several implications for non-caloric sweeteners. The replacement of sugar-sweetened foods and beverages with sugar-free products should theoretically reduce body weight, but many questions due to a positive link between use of NNS and BMI. Animal studies suggest that inclusion of NNS in the diet promotes energy intake and contributes to obesity. Users of NNS have traditionally been more likely to be female, dieting, and overweight or obese, so epidemiologic studies have been limited, since these products are used as much by both genders and normal weight individuals. Long-term RCTs will

be needed to resolve whether use of NNS can actually aid weight loss or prevention of weight gain. There was a brief discussion on the difficulty of running an RCT on sugar-sweetened beverages and NNS, a possible link between NNS and increased caloric intake due to palette-training, and whether NNS consumption should be encouraged.

Dr. Slavin moved to the next question: "What is the impact of liquids versus solid foods on energy intake and body weight?" The 2005 DGAC looked at this issue and found conflicting evidence on whether liquid or solid foods differ in their effect of calorie compensation. The new review considered literature from 2000 to present. The draft conclusion was, "When calorie consumption of preloads is balanced, there are few differences in energy intake between liquid vs solid treatments. Reductions in liquid calorie intake had a stronger effect on weight loss than did a reduction in solid calorie intake in the PREMIER study, but the difference was statistically significant only at 6 months, not 18 months. On energy restricted diets, soup consumption is associated with 50% greater weight loss. (Grade III)" This weight loss might be due to people eating less if they have soup before a meal. This topic had three implications: When macronutrient content of a liquid food and a solid food is balanced, there are little data that food form affects energy intake. Second, food structure may play a role in food intake. Whole foods play a role in satiety and decrease food intake at a subsequent meal. Third, studies with soup as a liquid calorie source support that liquid calories can be an aid to weight loss and that liquid calories from soup result in reduced intake at a subsequent meal.

The question, "What is the role of carbohydrates, fiber, protein, fat, and food form on satiety?" was addressed in a non-NEL review. The draft conclusion was, "Many factors affect satiety and most studies are conducted in laboratory settings to control for variables and thus results may not be generalized to the more complicated eating environment of the outside world. Foods high in dietary fiber generally are more satiating than low fiber foods, although some fibers added to drinks have little impact on satiety. Overall, small changes in the macronutrient content of the diet are unlikely to significantly alter satiety."

The final question, "What is the role of prebiotics and probiotics and health?" was addressed using a non-NEL review. The draft conclusion was, "The DGAC believes that the gut microbiota does play a role in health, although the research in this area is still developing. No recommendations for intake of prebiotics or probiotics for the American people can be made, although foods high in prebiotics (wheat, onions, garlic) should be consumed, as well as food concentrated in probiotic (yogurt)."

The members discussed linking fiber content to energy density. For added sugars, the discussion was on sugar-sweetened beverages, which are easier to quantify, show strong evidence, and may merit reconsideration of the grade or stronger language in the draft conclusion. Some of the better studies can be drawn out of the systemic reviews to keep them from being lost in the meta-analyses, as well as to bringing out the adult and child information.

Member Achterberg updated the Committee on the final question: "What is the relationship between the intake of vegetables and fruits, not including juice, and type 2 diabetes?" The topic was addressed by the 2005 DGAC, so an NEL update was performed. Six long-term prospective cohort studies were reviewed. The draft conclusion was, "Evidence is inconsistent but suggests

an inverse association between the development of type 2 diabetes and total V & F consumption. (Grade: III)" The strongest positive association was with French fries. In a brief discussion, members suggested more foreign studies, where vegetable intake is higher, and the difficulty of comparison across nations due to different fruits and vegetables consumed. Additionally, there was discussion on potatoes, which can't be treated the same as other fruits and vegetables.

Fatty Acids and Cholesterol Subcommittee
Chair: Thomas Pearson, M.D., Ph.D., M.P.H.

Thomas Pearson, Chair of the Subcommittee, thanked the Subcommittee members and staff. He addressed the topic, "What is the influence of dietary fat on cardiovascular disease and other health outcomes?" Under this topic, there were several sub-questions: monounsaturated fatty acids (MUFA), n-6 Polyunsaturated Fatty Acids (PUFA), seafood and seafood-derived n-3 PUFA versus plant and plant-derived *n*-3 PUFA, maternal intake of seafood and breast milk composition and infant health, and the associations between consumption of fats from high fat foods and health outcomes. The other topics were dietary components affecting plasma cholesterol and food pattern modeling questions on cholesterol and seafood.

The MUFA topic was expanded to two questions: "What is the effect of dietary intake of MUFA when substituted for saturated fatty acids (SFA) on increased risk of CVD and Type 2 diabetes mellitus, including intermediate health outcomes such as lipid/lipoprotein levels, markers of inflammation and blood pressure in the general population?" and "What is the effect of replacing a high carbohydrate diet with a high MUFA diet in Type 2 diabetics?" The data on these types of fat are from isocaloric dietary substitutions. The literature search was an update of the 2005 *Guidelines*. For the first question, the search was 2004 to present, looking at a healthy population with elevated disease risk. They found 11 studies with isocaloric substitution models for saturated fats and five with isocaloric substitutions of MUFA for carbohydrates. The draft conclusion was, "Dietary monounsaturated fatty acids (MUFA) are associated with improved health outcomes related to both CVD and T2D, when MUFA is a replacement for dietary saturated fatty acids (SFA). The evidence shows that 5% energy replacement of SFA with MUFA decreases intermediate markers and risk of CVD and T2D in healthy adults and improves insulin responsiveness in insulin resistant and T2D subjects." The evidence was Grade I. The second question, replacing carbohydrates with MUFA in type 2 diabetics, had five RCTs, two of positive quality, three neutral. All five supported the benefit of the substitution. With grade II evidence, the draft conclusion was, "Increased MUFA intake, rather than high carbohydrate intake, may be beneficial for type 2 diabetics. High MUFA intake, when replacing a high carbohydrate intake, results in improved biomarkers of glucose tolerance and diabetic control." The implications were that these were isocaloric studies, so the caloric density of fat should be taken into account; high MUFA diets were well-tolerated in all five studies; and there were favorable changes in glucose tolerance, inflammatory markers, and lipid and lipoprotein status in T2D. Key issues for future research are to determine if *n*-6 PUFA is more effective than MUFA in decreasing CVD and T2D risk and if MUFA replacement of carbohydrate is related to CVD and T2D clinical endpoints.

For PUFA, the research question was, "What is the effect of dietary intake of *n*-6 PUFA on risks of cardiovascular disease and type 2 diabetes, including intermediate health outcomes such as lipid/lipoprotein levels, markers of inflammation and blood pressure?" The inclusion criteria were

similar to the MUFA inclusion criteria, and the search went back to 2004. There were ten studies (5five RCTs, four prospective cohort studies, and one metaanalysis. Six studies were of positive quality, four neutral. PUFA replacement of saturated fat as a percent of energy improved intermediate markers and improved health outcomes. The core studies showed the conclusion of improving risk with trading PUFAs for MUFAs for cardiovascular disease and diabetes. With Grade I evidence, the draft conclusion was, "Dietary *n*-6 polyunsaturated fatty acids (PUFA) are associated with improved health outcomes related to CVD when PUFA is a replacement for dietary saturated fatty acids (SFA) or *trans* fatty acids. Evidence shows that energy replacement of SFA with PUFA decreases total cholesterol, LDL-C and triglycerides, as well as numerous markers of inflammation. PUFA intake significantly decreases risk of CVD and has also been shown to decrease risk of T2D." The implications are very similar to the MUFA implications. The recommendations assume an isocaloric replacement of SFA or *trans* FA with PUFA. Risk of CVD and T2D may be reduced with PUFA replacement of SFA, *trans* FA, or carbohydrates. Mechanisms of CVD risk reduction, including improvement in serum lipid levels and markers of inflammation, may have additional health benefits. A key issue for future research is to determine if n-6 PUFA is more effective than MUFA in decreasing CVD and T2D risks. In a brief discussion, the members touched on sources of MUFAs, the value of intermediate outcomes, and strengthening the conclusion statements on isocaloric substitution and the calorie density of MUFAs.

Member Rimm addressed sources of n-3 fatty acids. There was an existing ADA systematic review for this topic, so the NEL searches went back to 2007. The first research question was, "What is the relationship between consumption of seafood and seafood-derived *n*-3 fatty acids and the risk of cardiovascular disease (CVD) events in subjects without CVD and subjects with CVD?" The draft conclusion for subjects without CVD was, "The consumption of two servings of seafood per week (3-5 oz per serving), which provides on average 250 milligrams per day of n-3 fatty acids is associated with reduced cardiac mortality from coronary heart disease or sudden death in persons without previous cardiovascular disease." The evidence was Grade II. There were 27 studies . The implications were that consumption of seafood high in n-3 fatty acids and low in methyl mercury and other pollutants is desirable and feasible; efficient and eco-friendly strategies will have to continue to be developed to allow for greater consumption of seafood and seafood-derived n-3 fatty acids. Further research, especially RCTs, are needed to evaluate effects of increased consumption of seafood, as opposed to n-3 supplements.

For subjects with cardiovascular disease, the draft conclusion was, "The consumption of two servings of seafood per week (3-5 oz per serving) which provides an average of 250 milligrams per day is associated with reduced cardiac mortality from CHD or sudden death." The evidence was Grade II, but it was close to Grade I. There were four studies building on the ADA evidence analysis and the 2005 *Guidelines*. The studies found a protective effect of fish-derived n-3 fatty acids on risk of CVD and all-cause morbidity. The implications were the same as for subjects without CVD: that efficient and eco-friendly strategies will have to be developed to allow for greater consumption of seafood and seafood derived-fatty acids and the need for research on the long-term health effects of a recommendation to increase seafood consumption.

The next question was, "What is the relationship between consumption of a plant-derived *n*-3 fatty acid diet and the risk of cardiovascular disease (CVD) events in subjects without CVD and subjects With CVD?" For those without CVD, the draft conclusion, with Grade III evidence, was, "Alpha-

linolenic acid intake between 0.6-1.2 percent of total calories meets the prior recommendations for essentially fatty acids, and may lower CVD, but there is not sufficient new evidence to warrant greater intake beyond this level." There were eight studies (four prospective cohort studies, one systematic review, and three case control studies). Some studies found lower risk of CVD for higher ALA, but others did not. The results are mixed. The implications were that there is insufficient evidence to make a firm guideline to increase n-3 intake from plant sources; there is poor conversion from plan n-3 to marine n-3; and further evidence from RCT and prospective observational studies is needed among participants with a broad range of n-3 intake, especially with and without adequate intake of n-3 fatty acids from marine sources.

For the relationship between consumption of plant-derived n-3 fatty acids and risk of CVD events in subjects with CVD, the draft conclusion was, with Grade III evidence, "There is limited evidence that higher intake of n-3 from plant sources may reduce mortality among individuals with existing CVD." The evidence was one RCT, the Lyon Heart Study. It did find a protective effect for myocardial infarction (MI), but this was not solely an alpha-linolenic acid (ALA) study. The Subcommittee recommended RCTs to examine the impact of higher intakes of n-3 from plant sources in reducing mortality from CVD. The implications were that relatively little ALA converts to EPA or DHA, suggesting that plants derive n-3 fatty acids on a gram-per-gram basis alone may not provide the cardiovascular protective effects of DHA or EPA. There is insufficient evidence to make a formal guideline to increase n-3 intake from plant sources without additional randomized clinical trials and/or prospective studies, among participants across a broad range of n-3 fatty acid intake.

There was a discussion in which, Dr. Pearson commented on the importance of the efficient and eco-friendly strategy for the supply of fish, considering the environmental effects of increased fish consumption. Drs. Rimm and Nickols-Richardson discussed supplement studies, which are using high doses, making a threshold effect hard to determine. Dr. Appel noted that the question focused on seafood, not supplements, but the conclusions mention supplements. Dr. Rimm decided to remove the language, "seafood-derived fatty acids," and use instead of "seafood n-3 fatty acids." There was further discussion on whether the evidence addressed n-3 fatty acids or fish consumption, which could contain several nutrients in addition to the n-3 fatty acids.

Member Clemens spoke on fatty acids from seafood in breast milk. The research question was, "What is the effect of maternal dietary intake of *n*-3 fatty acids from seafood on breast milk composition and infant health outcomes?" The literature search went back to 2000 and studied healthy pregnant and lactating women and mother/infant pairs. There were nine studies (seven prospective cohort studies, one RCT, and one meta-analysis). Positive associations included visual acuity and neurological development, and methyl mercury risk was included in the studies. The draft conclusion was, "Increased maternal dietary intake of long chain n-3 PUFA, particularly docosahexaenoic acid (DHA), from two servings of seafood a week. That goes out to the three to five ounces twice a week is associated with improved infant health outcomes during pregnancy and lactation, such as visual acuity and cognitive development, and increased DHA levels in breast milk." The evidence was Grade II.

In a brief discussion, Dr. Clemens said the findings were consistent with data going back 30 years. There was discussion on the n-3 PUFA supplement trials, which use higher doses. The Food Safety

Subcommittee will address food modeling to mitigate methyl mercury concerns. The benefits of fish consumption outweigh the risks, but physicians often advise against fish consumption, so mothers are likely to get their n-3 fatty acids from supplements. The Subcommittee will add implications to this conclusion.

Member Pearson spoke on consumption of nuts and chocolate. The first research question was, "What are the health effects related to consumption of nuts?" The literature search was an update of ADA's 2004 systemic review. Health outcomes included CVD events, blood lipids, insulin sensitivity, and type 2 diabetes incidences. While seven studies looked at nuts in general, others looked at specific nuts: almonds (four studies), walnuts (four studies), macadamia (one RCT), and pistachios (two RCTs). Nut consumption was related to reduced CVD, metabolic syndrome, and cholesterol. All the nuts studied showed the lipid-lowering effect. The draft conclusion was, "Consumption of unsalted peanuts and tree nuts, specifically walnuts, almonds and pistachios, within an energy-balanced diet, has a favorable impact on cardiovascular disease risk factors, particularly serum lipid levels." The evidence was Grade II. The implications are that most nut consumption is in the form of peanuts, which are an important source of plant protein and other nutrients; and the recommendation was that consumption be limited to unsalted nuts to limit sodium intake. For future research, more RCTs are needed over a longer time to see if there are any other benefits. Second, more research is needed to make health distinctions between nuts. Many of the studies were industry-funded, and future study should be funded by non-industry sources.

The second question on this topic was, "What are the health effects related to chocolate?" The literature search went back to 2000. There were 13 studies (three systematic reviews, eight RCTs, 1 prospective cohort study, and one population-based case control study). The studies showed improvements in lipids levels, CHD and MI mortality. High-flavonoid chocolates also showed improved vascular flow, inflammation, and blood pressure. The draft conclusion was, "There are health benefits associated with the consumption of some types of dark chocolate or cocoa." The evidence was Grade II. There were five implications. The beneficial effects of chocolate have been attributed to the polyphenolic compounds. However, many plant foods contain polyphenolic compounds, and chocolate is a minor source. Potential health effects need to be balanced with caloric intake. Different formulations in chocolate have different polyphenolic profiles, so that is the mechanism. Different forms of chocolate may confer different benefits. Chocolate is currently a small component of the total diet, and benefits from the food is likely to be minimal.

The Members discussed defining moderate consumption in the conclusion statement and avoiding encouraging increased chocolate intake. Many of the studies were isocaloric, so the chocolate calories have to be consumed instead of something else. Chocolate has a high fat content, mostly stearic acid, and chocolate formulations very widely.

Member Clemens addressed the research question, "What effect does consuming natural or ruminant versus synthetic or industrially produced *trans* fatty acids (rTFA and iTFA, respectively) have on LDL, HDL and Non-HDL cholesterol?" Industrial trans fatty acids are produced by hydrogenation. The literature review went back to 2000, included healthy population and those at elevated risk, and looked at lipid and lipoprotein levels as outcomes. There were three studies (two RCTs and one non-systematic review). Coronary heart disease (CHD) endpoints showed no significant difference in associations between rTFA and iTFA; however, the rTFA levels in the

studies were unusually high. The draft conclusion was, "There is little evidence to support a substantial biological difference in the detrimental effects of rTFA and iTFA on health. The evidence does not suggest an appreciable effect on health from rTFA at the average current intake by the population of approximately 0.5 percent of energy." The studies had doses of approximately 5 percent of the energy level. The evidence was scored Grade II. The implications were that iTFA should be eliminated from the American diet; rTFA constitutes a small (~0.5%) proportion of calories and has little, if any, effect on serum lipids/lipoproteins or health outcomes; and rTFA are constituents of dairy products and meat, so complete removal of rTFA would restrict these nutrient-rich foods. The Subcommittee recommended more research to determine the effect of rTFA and iTFA on CVD/CHD risks.

Member Pearson moved on to the food modeling questions. The first question was, "What is the impact on food choices and overall nutrient adequacy of limiting cholesterol-raising (CR) fatty acids to <7% of total calories and to <5% of total calories, with CR fatty acids operationalized as total saturated fatty acids minus stearic acid?" Food patterns that would meet the nutritional goals within caloric limits would involve using lean ground beef, low fat or fat free cheeses, and baked chicken without skin. The USDA food patterns include foods only in nutrient-dense forms without excess solid fats. A small amount of discretionary calories (DC) is included. The current patterns contain 8 to 9 percent of calories from saturated fatty acids (SFA) and 6 to 7 percent of calories from CR fatty acids. To reduce CR fatty acids further, all solid fats were replaced isocalorically with oils, lowering cholesterol-raising fatty acids to 5 - 5.5 percent of calories and total SFAs to 7 percent.

The next modeling question was, "What is the impact on food choices and overall nutrient adequacy of limiting dietary cholesterol to less than 200 milligrams a day?" They found that cholesterol levels can be reduced to less than 200 milligrams per day by limiting eggs to less than two per week; reducing meats and poultry; and substituting some oils for solid fats. This would result in reductions in protein, choline, vitamin A, vitamin D, and EPA and DHA. Choline and vitamin D (already below adequate intake [AI]) would be reduced even lower, and EPA and DHA would be below the DRI. Vitamin E would be increased but would still be below RDA. The implications were that a diet can be constructed to limit daily cholesterol to less than 200 mg per day, but the low-cholesterol diet would further reduce intake of nutrients that do not meet adequate intake (AI) recommendations in the base patterns. The cholesterol intake of less than 200 mg per day should target subgroups at high risk of CVD or T2D, given the limited data on benefits to the general population.

Member Rimm spoke on the seafood modeling question: "What is the impact on nutrient adequacy of increasing seafood in the USDA food patterns to 4 oz/week of seafood high in n-3 fatty acids (EPA and DHA) (HI3); 8 oz/week of seafood, including seafood both low (LO3) and high in n-3 fatty acids in proportions currently consumed; or 12 oz/week of seafood low in n-3 fatty acids?" This was modeled due to the evidence of the benefits of 250 mg per day of n-3 fatty acids. In the model, the seafood servings replaced servings of meat and poultry. The amount of eggs, nuts, seeds, soy, and solid fats were not modified. The recommended food subgroup intakes were adjusted based on a 2000 kcal pattern and compared to the recommended daily allowances (RDAs) from the 2006 IOM report and compared EPA and DHA to base patterns. There was no substantial change in energy, protein, carbohydrate, total fat, cholesterol, saturated fat, MUFAs, or PUFAs. There were increases in selenium, vitamin D, and vitamin B-12. Overall, The amounts of seafood in the USDA food patterns could be increased to the levels specified without any negative impact on nutrient

adequacy, and using these patterns would achieve daily DHA plus EPA per day levels of 296 milligrams in the HI3 group, 259 milligrams in the middle group, and 250 mg per day for those people who had three servings of LO3 fish. This analysis did not include methyl mercury, but species of interest can be identified and the impact estimated.

Energy Balance and Weight Management Subcommittee
Chair: Xavier Pi-Sunyer, M.D., M.P.H.

Xavier Pi-Sunyer, Chair of the Subcommittee opened the presentation by recognizing the members of the Subcommittee. He outlined the topics for the presentation: food environment and dietary behaviors, breastfeeding and maternal weight change, childhood adiposity, macronutrient proportions, and weight loss/maintenance for older adults.

Member Nelson discussed changes in the food environment over the past four decades, including increased eating outside of the home and increased access to high-calorie foods. Her research question was, "What effects do the food environment and dietary behaviors have on body weight?" Her proposed conclusion was, "Substantial evidence indicates that the food environment is associated with dietary intake, especially less consumption of vegetables and fruits (Grade II) and higher body weight (Grade II)." The implication was that policy and private-sector efforts must to be made to increase the availability of healthy foods for all Americans, especially low-income Americans, through greater access to grocery stores, produce trucks, farmers markets, and greater financial incentives to purchase and prepare healthy foods. Her NEL review of ten systematic reviews published since 2000 indicated that availability of healthy foods, including vegetables and fruits, is inversely associated with weight status, especially in economically disadvantaged areas, while increased density of fast food restaurants and convenience stores is related to higher BMI.

Dr. Nelson then addressed the relationship between body weight and various behaviors: eating out, portion size, screen time, breakfast consumption, snacking, eating frequency, and diet self-monitoring. For eating out, the NEL review went back to 2000 and included children and adults. The proposed conclusion was, "There is strong and consistent evidence that children and adults who eat fast food are at increased risk for weight gain, overweight, and obesity. The strongest relationship between fast food and obesity is seen when one or more fast-food meals are consumed per week. There is not enough evidence at this time to evaluate eating out at other restaurants and risk of weight gain, overweight, and obesity." The proposed implication was that if people eat fast food, they are encouraged to choose lower calorie options and smaller portions, while the industry is encouraged to offer healthier choices in appropriate portions. The evidence was Grade I. In both adults and children, there were six articles (one systematic review and five cohort studies), all looking specifically at fast food.

For portion size, the proposed conclusion for the update was, "There is strong evidence that there is a positive relationship between larger portion sizes and body weight. (Grade I)" The proposed implication was to encourage people to prepare, serve, and consumer smaller portions at home and choose smaller portions when away from home. The issue was addressed in the 2005 *Guidelines*. For the update, no articles were found for children; four articles (three RCTs and one case-control study) were found for adults.

For screen time, the proposed conclusion was, "There is strong and consistent evidence in both children and adults that screen time is associated with increased overweight and obesity. The strongest association is with television screen time." The evidence was Grade I. The proposed implication was that children and adults should limit screen time, especially television viewing, and not eat food while watching television. The American Academy of Pediatrics' recommendation is for no more than one to two hours of total media time for children and adolescents and no television viewing for children under 2 years old. A Healthy People 2010 objective is to increase the proportion of adolescents viewing television two or fewer hours on school days. The NEL review showed a positive relationship between screen time and adiposity in children and weight in adults.

For breakfast consumption, the proposed conclusion was, "There is modest evidence that children who do not eat breakfast are at increased risk for overweight and obesity. The evidence is stronger for adolescents. There is inconsistent evidence that adults who skip breakfast are at increased risk for overweight and obesity." The evidence was Grade II in children, Grade III for adults. The proposed implication was that children and adults are encouraged to consume a nutrient-dense breakfast.

The relation between snacking and body weight was difficult to assess because different studies defined snacking differently. The evidence was Grade III. The proposed conclusion was, "There is inconsistent evidence to suggest that snacking is associated with increased body weight. The reason for the inconsistency is the variability in design and definitions for snacking." The proposed implication was, when snacking, Americans are encouraged to choose foods that help meet their nutrient needs while staying within calorie needs. Of the six articles on children, three found a positive relationship between snacking and adiposity. Three did not find a relationship between snacking and adiposity. There were two prospective cohort studies on adults, both showing a positive relationship.

For eating frequency, the proposed conclusion was, "There is insufficient evidence that frequency of eating has an effect on overweight and obesity in children and adults." The evidence was Grade III. The proposed implication was that children and adults be encouraged to follow a frequency of eating that provides nutrient-dense foods throughout the day within daily caloric requirements. The NEL review looked at weight and weight maintenance over time. There was one prospective cohort study finding a negative relationship between eating frequency and adiposity in girls. The one prospective cohort study on adults found a positive relationship. There was insufficient data to make a conclusion.

For diet self-monitoring in adults, the evidence was Grade I. The proposed conclusion was, "There is strong evidence that for adults who need or desire to lose weight, or who are maintaining body weight following weight loss, self-monitoring of food intake improves outcomes." Of the seven articles identified, six found an improvement in weight with self-monitoring. The proposed implication was to encourage adults to self-monitor food intake to improve outcomes when actively losing weight or maintaining body weight following weight loss. There is evidence that self-monitoring of body weight and physical activity improves outcomes when actively losing weight or maintaining body weight following weight loss.

There were several recommendations for future research: more research on environmental influences and body weight, intake, and health outcomes; macro-level research on the effect of local and national food systems on dietary intake and health outcomes; research on snacking and meal frequency as related to body weight and obesity, with better definitions of snacking; research on how to influence the fast food and restaurant industries to improve food quality and reduce portion size; and more research on other behaviors that might influence eating practices.

In a brief discussion, Dr. Appel suggested that other factors, like socioeconomic status, could be triggering the obesity rates. Members discussed fast food restaurants in high density areas or near schools. Dr. Appel requested that diet self-monitoring be described in more detail, mentioning calories specifically. The report will show the change in food environment since the 1970s.

Member Pérez-Escamilla discussed the research question, "What is the relationship between breastfeeding and maternal weight change?" which was not addressed in the 2005 *Guidelines*. The NEL review looked at systematic reviews and meta-analyses going back to 2000. With Grade II evidence, the proposed conclusion was, "Consistent evidence shows that breastfeeding may be associated with moderate maternal postpartum weight loss." However, the weight loss observed is small, transient, and depends on breastfeeding intensity and duration. Maximum weight loss is observed between three and six months postpartum among women exclusively breastfeeding. Only 33% of women in the US breastfeed exclusively at three months. Lactation increases energy demands, but it also increases appetite and is not known to increase physical activity levels. The proposed implications are that it is unlikely that breastfeeding plays a significant role in postpartum weight loss in the US and it should not be promoted as a postpartum weight loss method. The members discussed breastfeeding and child weight, for which the data is mixed.

Member Williams discussed a series of questions on how dietary intake is associated with childhood adiposity. Additional questions from this overarching topic were presented at the public meeting in November 2009. The first sub-question was, "Is intake of total energy (caloric) associated with adiposity in children?" Building on the 2004 ADA review, the NEL review went back to 2004. The proposed conclusion was, "The preponderance of evidence from a review of the recent scientific literature tends to support a positive association between total energy (caloric) intake and adiposity in children." The evidence was Grade III. Of the four studies, three found a positive association between energy intake (EI) and adiposity. The one that did not did not adjust for implausible EI reports. The studies in the ADA review reported mixed results. More recent studies show that overweight children underreport EI and total intake among obese children is greater than among children of normal weight. Strategies to prevent childhood obesity should include efforts to reduce surplus energy intake, especially energy from foods and beverages that provide empty calories from added sugars and solid fats.

The second sub-question was, "Is dietary fat associated with adiposity in children?" The NEL review was an update of the 2004 ADA review. The proposed conclusion was, "Review of the evidence suggests that increased intake of dietary fat is associated with greater adiposity in children. (Grade II)" Of the five longitudinal studies in the NEL review, three found a positive association between total fat intake and adiposity. Two other longitudinal studies and one RCT

did not find an association. The ADA review associated fat intake with higher adiposity in children. The implications were that diets high in total fat can result in passive over-consumption of energy, since fat is so palatable and energy dense; currently, one-fourth of US children still have average daily intakes that exceed the Institute of Medicine (IOM) Acceptable Macronutrient Distribution Range (AMDR) for age; about 40% of the total energy intake for 2-18 yr old US children comes from empty calories, of which about half comes from solid fats; total fat intake should not exceed the IOM acceptable ranges and should consist primarily of MUFAs and PUFAs that promote heart health and provide essential fatty acids for growth and development.

The third sub-question was, "Is intake of calorically-sweetened beverages associated with adiposity in children?" The NEL review was an update of the 2004 ADA review. The proposed conclusion was, "A moderate amount of evidence supports the conclusion that greater intake of calorically-sweetened beverages is associated with increased adiposity in children. (Grade II)" The NEL review included ten longitudinal studies and one RCT. Seven of the longitudinal studies and the RCT found a positive association and three found no association. The ADA review positively related calorically-sweetened beverages to adiposity. The implication was, the principal sources of energy among children should be MyPyramid core foods, after which there are few discretionary calories remaining before energy needs are exceeded. Unfortunately, about 40% of children's total EI comes from added sugars and solid fats, contributing to energy surplus and risk of obesity. Calorically-sweetened beverages are a major source of added sugars among children. Consumption of calorically-sweetened beverages should be discouraged.

The next sub-question was, "Is intake of calcium and/or dairy (milk & milk products) associated with adiposity in children?" The NEL review was an update of the ADA review. The proposed conclusion was, "The NEL review provides little convincing evidence that intake of calcium and/or dairy (milk and milk products) plays a significant role in regulating adiposity in children and adolescents. (Grade III)" The NEL review contained 13 studies. Of the five RCTs, one found a protective association between intake of dairy and adiposity. The other four had mixed results or no association. Of the five longitudinal studies, two found evidence of a protective association between calcium and dairy intake and adiposity. Two had mixed results or not association, though one study found a positive association between calcium intake and adiposity in adolescents. The ADA review concluded that a low intake of dairy may be associated with increased adiposity among children. The implications were, although there is insufficient evidence that intake of calcium or dairy products play a significant role in regulating adiposity in children and adolescents, milk and milk products are nutrient-rich foods for children and adolescents, providing three-fourths of the calcium in the US diet, essential amino acids, macronutrients, riboflavin, and high quality proteins. Children should be encouraged to consume recommended servings of low-fat dairy products daily in order to meet recommended dietary intake levels for key nutrients such as calcium.

The last sub-question was, "Is dietary fiber associated with adiposity in children?" The NEL search went back to 1980. The proposed conclusion was, "Since so few clinical trials and longitudinal cohort studies have examined the association between dietary fiber intake and changes in adiposity in children, there is insufficient evidence at the present time to support the hypothesis that dietary fiber may protect against increased adiposity. (Grade III)" The review

included five articles (two RCTs and three longitudinal studies). The RCT results conflict with each other, and all of the longitudinal studies showed no association. The implications were that dietary fiber is often a marker for a healthy, nutrient-rich, lower-fat diet. Fiber is associated with lower serum cholesterol and is important in healthy gastrointestinal function. Fiber may promote healthy weight for reasons of satiety and energy density. Fiber is part of a healthy dietary pattern, and most US children consume less than is recommended. Children should be encouraged to consume greater amounts and varieties of fiber regardless of its effect on weight.

In brief discussion, Dr. Perez-Escamilla questioned the grading of the evidence on the association between dairy and adiposity. Members generally agreed that the evidence against an association can be raised to Grade II. There was also discussion of potential satiety-signaling components in milk. Some of the total energy intake studies did not adequately take physical activity into account. Also, "calorically-sweetened" beverages can be changed to "sugar-sweetened," for consistency. There was discussion of the fiber trials that used supplements with no consideration of dietary fiber or eating behavior. Dr. Appel pointed out that the recommendation on sugar-sweetened beverages should specifically state the percentage of calories children get from these beverages. Dr. Rimm warned that reducing the fat in children's diets will increase processed carbohydrate intake. Special attention should be paid to saturated fat.

Member Pi-Sunyer discussed the relationship between macronutrient proportion and body weight. The overall question: "What is the relationship between macronutirent proportion and body weight?" was followed by subquestions. The literature review went back to 2004 and looked at adults. For the overall question, the proposed conclusion was, "When calorie intake is controlled, the macronutrient proportion of the diet is not related to maintaining a healthy body weight, losing weight, or avoiding weight gain. Weight loss can be achieved through changing macronutrient proportions, but this effect does not last. Dietary patterns with macronutrient proportions that are outside the Dietary Reference Intakes (P 10-35%; CHO 45-65%; F 20-35%) are difficult to maintain over the long term and also raise some safety questions."

For the subquestion, "What is the optimal macronutrient proportion to maintain a healthy body weight, to lose weight if overweight or obese, and for weight loss maintenance?" the first issue was maintaining body weight, for which the proposed conclusion was, "The limited number of studies that addressed this suggest that carbohydrate intake is negatively associated with BMI and that normal body weight (BMI<25 kg/m^2) is associated with a carbohydrate intake at the level of 40-65% of total calories. (Grade III)" This conclusion was based on two cross-sectional studies, both finding that people of normal weight were more likely to consume a diet higher in carbohydrates than overweight or obese individuals. The second part of that question was weight loss for overweight and obese adults. The proposed conclusion was, "When overweight/obese persons attempt to lose weight with reduced calorie intake, there are no differences in weight loss with differing macronutrient proportions if diets are followed for longer than 6 months. In shorter term studies, low-calorie high-protein diets may result in greater weight loss, but these differences are not sustained over time. (Grade I)" This conclusion was based on 36 articles, of which 20 found no relationship between macronutrient proportion and weight loss and 17 found low-carbohydrate or high-protein diets to be most effective. For weight management, the proposed conclusion was, "There are no data to suggest that any one macronutrient proportion is

more effective for avoiding weight regain in weight reduced persons. (Grade II)". Of the 12 articles reviewed, 10 studies showed no relationship between macronutrient proportion and weight loss. Two showed that low carbohydrate or high protein diets were more effective.

The next subquestion addressed low-carbohydrate hypocaloric diets. The research question was, "Are low-CHO (<45%) hypocaloric diets safe and effective for long-term (>6 mo) weight loss/maintenance?" The proposed conclusion was, "Diets with <45% of calories as carbohydrates are not more successful for long-term weight loss (12 months). There is also some evidence that they may be less safe. (Grade II)." Of the 15 articles reviewed, nine found no relationship between macronutrient proportion and weight loss. Two found that low-carbohydrate diets are more effective than low-fat diets, but two studies associated low-carbohydrate diets with increased mortality, especially CVD mortality.

The last sub-question was on high-protein diets: "Are high-PRO (>35%) hypocaloric diets safe and effective for long-term (>6 mo) weight loss/maintenance?" The proposed conclusion was, "Intake of diets higher in protein than accepted standards (>35% of total calories) provide no advantages for weight loss/maintenance or for improved health biomarkers compared to other diets with differing macronutrient composition. Also, such diets may be less safe than diets within the DRI ranges for macronutrients. (Grade II)". There were four articles (three RCTs and one cohort) reviewed for this sub-question. The RCTs found no relationship between macronutrient proportion and weight loss. The cohort study associated low-carbohydrate high-protein diets with increased mortality, especially CVD mortality.

The proposed overall conclusion was that when calorie intake is controlled, the macronutrient proportion of the diet is not related to maintaining a healthy body weight, losing weight, or avoiding weight gain. Weight loss achieved through changing macronutrient proportions does not last. Dietary patterns with macronutrient proportions that are outside the DRIs (P10-35%; CHO 45-65%; F 20-35%) are difficult to maintain over the long term and raise safety questions.

Member Pi-Sunyer began discussion on the effect of weight loss in older adults on health outcomes. However, due to a sound issue, Chair Van Horn announced the topic would be covered first on the agenda for the second day of the meeting and adjourned the meeting.

(Recess: 4:07 p.m.)

Wednesday, April 14, 2010 (9:00 a.m.)

Remarks from the Chair

Chair Van Horn called the meeting to order.

Energy Balance Subcommittee
(Report Continued)

Member Pi-Sunyer resumed with the effects of weight loss in older adults on health outcomes. The research question was, "For older adults (age ≥ 65) what is the effect of weight loss versus weight maintenance on selected health outcomes (cardiovascular disease, type 2 diabetes, cancer, and mortality)?" This question was not addressed in the *2005 Dietary Guidelines Advisory Report*. The NEL search went back to 1995. The proposed conclusion was, "In older adults, mortality associated with BMI is U-shaped, increasing below 18.5 and also rising beginning at 27 to 34 (depending on the study). Weight loss in older adults is associated with an increased risk of mortality. Most studies have not differentiated between intentional versus unintentional weight loss, so no conclusion can be reached on this. Weight maintenance is associated with a lower risk of mortality, while weight gain produces increased risk. There are insufficient data regarding the risk of developing diabetes, cardiovascular disease, or cancer to come to any conclusions." The evidence was Grade II. However, due to a recent publication that showed a significant relationship between weight loss and decreased mortality, Dr. Pi-Sunyer suggested changing the conclusion to state that there is no risk and there is an advantage to weight loss after age 65. The NEL review included 35 articles: 32 cohort studies, 2 longitudinal studies, and 1 structural equation model. Although mortality was higher in the groups that lost weight overall, that did not translate to a higher rate of CVD or diabetes, and those who lost weight intentionally did not show higher mortality.

The Subcommittee's research recommendations were that there be RCTs on the effect of intentional weight loss on mortality and developing diabetes, cardiovascular disease, and cancer in the elderly. The proposed implication was, "Maintenance of weight seems the prudent advice for elderly patients. Since the majority of the studies available have not differentiated between intentional versus unintentional weight loss, preventing weight loss is reasonable. Weight gain, however, should also be prevented." However, due to the two studies that distinguished intentional from unintentional weight loss, the implication was changed to say it is safe to lose weight after age 65 and to maintain the weight loss.

Discussion

Dr. Nelson clarified that it is safe for people who are overweight or obese to lose weight, not for those at an ideal weight. She added that the question on optimal macronutrient proportion did not contribute much to the overall conclusion, and Dr. Appel suggested dropping this sub-question. Dr. Appel suggested the chapter more prominently address calorie sources and sort by age and sex. Dr. Nelson said that can be incorporated into the section on behavior and environment. Dr. Van Horn supported putting the information in the Energy Balance section. She noted that the older population requires less energy. She suggested that Dr. Williams' summary on the dietary

intake of children be used to model the other age groups in order to standardize the format. Dr. Appel and Dr. Pi-Sunyer discussed trials, which showed benefits of weight loss but did not focus on mortality. Dr. Fukagawa suggested looking at the kinds of weight-reduction diets older people use. Dr. Rimm said compliance is the most important aspect of any diet; being mindful of what you are eating is as important as what you are eating.

Nutrient Adequacy Subcommittee
Chair: Shelly Nickols-Richardson, Ph.D., R.D.

S**helly Nickols-Richardson, Chair of the Subcommittee**, recognized the Subcommittee members and staff. One question the Subcommittee had discussed was whether the term "nutrient-dense" should continue to be used by the 2010 DGAC and included in the *2010 DGAs*. The concept is theoretically valid and well-understood by nutrition professionals, distinguishes nutrients from energy, and can help consumers make food choices that meet nutrient needs within fixed calorie levels. However, there are a variety of methods for defining nutrient density, and nutrient-dense foods are not necessarily nutrient-rich. There is debate on whether naturally nutrient-rich foods are better than fortified foods. The Subcommittee decided to continue to use the term under the 2005 definition: foods that provide substantial amounts of nutrients and relatively few calories, and to focus on forms of food that are low in solid fats and do not have added solid fat, sugar, starches, or sodium. A wide range of foods that are prepared without added solid fats or sugars are considered nutrient-dense, when they are in lean or low-fat forms. The DGAC did not advocate a specific calculation method. The Subcommittee wanted to encourage consumption of nutrient-dense foods of lower energy density, rather than "food-like substances" enhanced with nutrients.

Another question was whether "Discretionary Calories" should continue to be used by the 2010 DGAC and included in the *2010 DGAs*. The concept is theoretically valid and the "Calories from SoFAAS" concept has successfully operationalized discretionary calories. "SoFAAS" (solid fats, alcohol, and added sugars) is useful in dietary quality assessment, and SoFAAS, when expressed as "calories from extras" has been useful in consumer materials. However, the concept of discretionary calories is difficult for consumers to understand. Setting a discretionary calorie allowance suggests that the calories are needed. Limiting SoFAAS intake must be promoted within limiting total calories. The Subcommittee decided to use modeling to determine the maximum amounts of calories from non-essential nutrient sources that can be consumed while staying within energy needs after accounting for recommended intakes of nutrient-dense forms of foods from all food groups, this number represents the maximum limit for calories from solid fats and added sugars (SoFAS), and Americans should avoid these additional calories. The Subcommittee will move away from using "discretionary calories" and focus on limits for SoFAS.

In discussion of these terms, Dr. Nelson suggested using the language "usually in its most natural state" in the description of nutrient-dense foods. There was discussion of the term "discretionary calories," noting that the concept is valid and this represents a refinement. Members commented that for most people there are very few discretionary calories.

Dr. Nickols-Richardson presented on dietary components overconsumed, which was a new question for 2010. The question was, "What nutrients and dietary components are most likely to be consumed by the general public in amounts high enough to be of concern?" The draft conclusion was, "Estimated intakes of the following nutrients and dietary components are high enough to be of concern: For adults: total energy intake, particularly energy intake from solid fats and added sugars; sodium; percentage of total energy from saturated fats; total cholesterol (only in men); and refined grains; For children: energy intake from solid fats and added sugars; sodium; percentage of total energy from saturated fats; total cholesterol (only in boys, aged 12 to 19 years); and refined grains." The evidence came from the National Cancer Institute, Food and Nutrition Service reports, and the *IOM Report on School Meals*, all of which used NHANES data. Typical intake was compared to DRIs and limits from USDA food patterns, looking at total energy, energy from SoFAS, sodium, saturated fats, cholesterol, and refined grains. For total energy, children 2-11 have a mean energy intake that is at the level appropriate for very active individuals. Though the levels appear better in adults, underreporting is a problem with overweight adults. Especially in children, there is a problem with energy intake compared to physical activity. In energy from SoFAS, more than 95% of every age group except for those over 70 years of age is above the maximum limit. For adults, SoFAS make up a third of all calories. The focus here is on calories from solid fats and added sugars (SoFAS), not including alcohol, because fewer calories come from alcohol overall, and not all age groups consume it. All age and sex groups are above adequate sodium intake and most are over the upper limit. About 50 percent of the population is over the limit of calories from saturated fats. Approximately fifty percent of males over 14 exceed the maximum cholesterol limit. All age and sex groups are over-consuming refined grains. The draft implication was, "To lower overall energy intakes without compromising nutrient intakes, Americans should focus on lowering consumption of calories in the form of SoFAS. Efforts are warranted to lower total sodium intakes, promote lower intakes of saturated fats and total cholesterol (in males older than 12 years), and to lower refined grains intakes and replace with high-fiber whole grains." The Subcommittee's research recommendation was to develop and test behavior-based interventions designed to lower dietary intakes of nutrients and dietary components overconsumed, focusing on SoFAS.

The members suggested getting trend data for the intake levels, particularly for saturated fat and sugar intake, noting that low-fat campaigns tend to cause increased carbohydrate consumption. There was discussion on where to place all the intake information in the report and that cross-referencing would help lead readers to the data.

Dr. Nickols-Richardson's next topic was food groups of concern. The research question was, "What food groups and selected dietary components are most likely to be consumed by the general public in amounts low enough to be of concern?" This was a new question for 2010. The draft conclusion was, "Reported dietary intakes of the following food groups and dietary components are low enough to be of concern: for adults and children, vegetables, fruits, whole grains, fluid milk and milk products, oils; for adult women and adolescent girls, meat, poultry, fish, eggs, soy products, nuts, and seeds." The evidence came from the same sources as the previous question. Typical intake and amounts per day and week were compared to the USDA food patterns, looking at vegetables, fruits, grains, fluid milk and milk products, the meat group, and oils. Median intake of vegetables was below recommended levels in all sex and age groups.

Inadequate intake is linked to shortfalls in potassium; fiber; magnesium; vitamins A, C, and K; and folate. Intake was short in all vegetable subgroups except for the other vegetables group. Only children two to three years old meet the recommended intake for fruit. While all sex and age groups meet recommended grain intake, none of the groups come close to meeting the recommended whole grains intake. From the ages of nine on, both sexes have lower than recommended milk intake. Median meat and bean group intake in women over 19 does not meet the recommendation. No age or sex group reaches recommended intake of oils.

The Subcommittee's draft implication was: "Efforts are warranted to promote increased intakes of vegetables (especially dark-green vegetables, red-orange vegetables, and dry beans and peas), fruits, and whole grains, and substitution of oils for solid fats, regardless of age; increased intakes of fat-free or lowfat fluid milk and milk products by children, aged 4 to 18 years, and adult men and women; and increased intakes of lean, iron-rich meat, poultry and fish by adult women and adolescent girls. Intakes of nutrient-dense forms of foods—that is, foods in forms that are lean or low in solid fat and without added solid fats, sugars, starches or sodium—from these basic food groups should replace foods in the current American diet that contribute to high intakes of solid fats and added sugars (SoFAS) and refined grains." The Subcommittee recommended clinical trials in children and adults to examine the impact of adherence to the 2010 Guidelines on body weight change, cardiovascular disease, type 2 diabetes, cancer, osteoporosis, and other endpoints. They recommended quantitative and qualitative investigation of how the food environment facilitates or hinders achievement of recommendations, especially in individuals in food assistance programs and in various ethnic and cultural groups.

The members discussed increasing intake of shortfall foods and shortfall nutrients. Dr. Williams said industry help would be needed to reduce solid fat intake in children. Dr. Perez-Escamilla said the shortfalls merit a strong statement on increasing nutrient density in the diet. Members spoke on increasing access to and awareness of underutilized foods. There was discussion of the meat and beans group, which led to the conclusion that people should eat higher-quality protein and omega-3 fatty acid-rich foods and concern about iron deficiencies in women of reproductive age. There was discussion of renaming the food group "protein" in order to reduce the emphasis on meat. This raised the concern of the group becoming nutrient-based rather than food-based. Another idea was to disaggregate the food group.

The next topic was nutrients of concern, which are vitamin D, calcium, potassium, and dietary fiber. These have been presented at a previous meeting, so the presentation focused on evidence for vitamin D and food pattern modeling for calcium.

Member Nelson presented on vitamin D. To the sub-question: "Is vitamin D a nutrient of concern?" the proposed conclusion was, "Strong evidence indicates that many children and a majority of adults do not meet the AI for vitamin D. Furthermore, a significant portion of the population has deficient or inadequate blood levels of vitamin D to promote health and prevent chronic diseases, such as poor bone health and possibly certain types of cancers, cardiovascular disease, and immune-related disorders. This is especially apparent in people living in northern latitudes, in persons with dark skin, and in overweight and obese adults." In the past eight years, there has been research on vitamin D going beyond bone health. DGAC did not conduct an NEL review because IOM has empanelled an expert committee to review the 1997 DRI for vitamin D.

The results are expected in the summer of 2010. The review strategy was to review proceedings from the National Institutes of Health (NIH) conference *Vitamin D and Health in the 21st Century: an Update*, an NIH roundtable discussion with expert scientists held after the conference, and the Agency for Healthcare Research and Quality (AHRQ) evidence report, *Vitamin D and Calcium: A Systematic Review of Health Outcomes.* They also examined current vitamin D intake and status. In addition to vitamin D's role in bone health, the immune system, the cardiovascular and reproductive systems, there is emerging research on vitamin D reducing the risk of type 1 diabetes, some cancers, autoimmune diseases, and infectious diseases. According to NHANES data, most people do not meet the current AI for vitamin D, including over 65 percent of children. The draft implication was that all children, adults, and the elderly are encouraged to meet the AI for vitamin D. Those with inadequate blood levels of vitamin D should consume more naturally-occurring and fortified vitamin D-rich foods and consider supplementation. The research recommendations were more high-quality, long-term dose response studies with health outcomes including bone, immune system, autoimmune disorders, and chronic diseases as well as investigation of the metabolic partitioning, fate, and mobilization of key vitamin D metabolites at recommended and greater than recommended levels.

The members spoke about the supplement recommendation. Although the Committee does not generally recommend supplementation, it is difficult to get enough vitamin D naturally. Most vitamin D fortified foods are fortified under regulatory constraints, making it difficult for industry to respond to recommendations. These shortfalls are linked to lack of sun exposure and substitution of sugar-sweetened beverages for milk. Dr. Van Horn raised the concern about being evidence-based without evidence on supplements. Members discussed the validity of testing blood levels, especially when there is no accepted normal range. Dr. Nelson decided to remove the discussion on blood and to stick to intake levels, as well as to add a paragraph on upcoming technologies.

Member Nickols-Richardson addressed the next nutrient of concern: calcium, which is also currently under IOM review. Food pattern modeling was done to address three sub-questions: A, "What is the impact on nutrient adequacy if: 1) no fluid milk or milk products are consumed; and 2) calcium is obtained from nondairy sources or other fortified foods rather than fluid milk and milk products?" B, "What nondairy calcium sources or fortified foods are the most feasible alternatives to milk products for those who choose not to consume dairy foods?" and C, "How would the nutrients provided by the milk group be changed if more lowfat or fat-free fluid milk and less cheese were consumed?"

The food pattern modeling rationale was that many Americans fall short of the recommended intake levels for fluid milk and milk products, some individuals desire non-dairy calcium sources various reasons, and relative proportions of fluid milk and cheese consumption have changed over time. The findings for subquestion A was, "When fluid milk and milk products are removed from the USDA food patterns, calcium drops substantially below the AI across all energy levels. In addition, vitamins D and A, and choline, magnesium, phosphorus, and potassium also fall below 100% of DRI levels in some or all patterns." For subquestion B, the finding was, "Of the nondairy alternatives evaluated as a substitute for fluid milk, yogurt, and cheese in the USDA food patterns, soymilk fortified with calcium and vitamins A and D is the alternative with the most similar nutrient profile to fluid milk." For sub-question C, the findings were, "When fat-free fluid milk is substituted for some or all of the low-fat cheese in the USDA food patterns, 1) energy, protein, and calcium

levels remain similar; 2) vitamin A, and choline, magnesium, and potassium increase slightly; 3) sodium, cholesterol, and saturated fatty acids decrease slightly; and 4) vitamin D content is substantially improved across energy levels." The draft implications were that individuals who avoid fluid milk and milk products because of its lactose content should be clinically diagnosed to determine whether or not to eliminate dairy from the diet and that lactose-reduced or low-lactose dairy-based products or fortified soymilk may assist some individuals in meeting nutrient needs.

The members discussed the price differences of the substitutions. Dr. Appel and other members wondered if recommendation of clinical diagnosis of lactose intolerance was merited. However, many people have perceived lactose intolerance that can be psychosomatic or a protein allergy. The implications in the report will be rephrased.

Member Nickols-Richardson presented on two additional shortfall nutrients. The choline sub-question was, "Are subgroups of the overall population at risk for inadequate choline intakes and does this present a significant public health concern?" The outcome was, "While dietary intakes of choline across all age and gender groups is low compared to AIs, there is a lack of human clinical trials to suggest major public health concerns related to current choline intakes. Most Americans could meet their AIs for choline by consuming modest amounts of eggs and replacing other meat, poultry, fish, and starchy vegetables with dry beans and peas, within fixed energy intakes." Although choline is a shortfall nutrient, it is not a nutrient of concern.

For phosphorus, the question was, "Are subgroups of the overall population at risk for inadequate phosphorus intakes and does this present a significant public health concern?" The outcome was, "While dietary intakes of phosphorus among girls, aged 9 to 18 years, suggest inadequacy for these subgroups, there is a lack of human clinical trials to suggest major public health concerns related to current phosphorus intakes. Most young girls could meet phosphorus recommendations by consuming meat, poultry, and fish that would also support dietary iron intakes, as well as dry beans."

In brief discussion, Dr. Pearson suggested emphasizing non-egg sources of choline, due to cholesterol concerns. Members discussed choline as a shortfall nutrient and choline and folic acid in pregnant women. There are ongoing clinical trials looking at choline and neural tube defects.

Member Nickols-Richardson moved on to nutrient issues for selected population subgroups, looking at folate, B12, and iron. The folate food pattern modeling sub-question was, "What is the impact on intake of folate and other nutrients of selecting all grains as whole grains rather than half whole and half enriched refined grains?" The modeling rationale was that the 2005 *Guidelines* recommended that at least half of all grains be whole grains. The most commonly eaten refined grains are fortified with folate and enriched with iron and B-vitamins. The modeling process assumed that proportions of non-whole grain products are maintained but replaced with whole grain versions, fortified whole grain ready-to-eat cereals are included at levels currently consumed, and non-whole grain ready-to-eat cereals are replaced with non-fortified whole grain cereals or fortified whole grain cereals. The findings were that when all recommended grains are whole grains and the whole grains are not fortified, the dietary patterns are insufficient for dietary folate for girls 14-18 years old, women of all ages with low to moderate energy needs, and men older than 50 with relatively low energy needs. Dietary patterns were low in iron for children two to eight years old

and then adolescent girls and women age 14 to 50 years. When all recommended grains are whole grains and the whole grains include fortified ready-to-eat cereals, dietary patterns are adequate for folate and iron. The draft implication is that if individuals desire to consume only whole grains in their dietary patterns, some of those whole grains should be fortified.

For iron, the draft conclusion was, "Substantial numbers of adolescent girls and women of childbearing age have laboratory evidence of iron deficiency." According to NHANES data, 15 to 17 percent of women of reproductive age do not meet daily requirements. According to NCI data, about 75 percent of 14 to 18 year old women and 60 to 31 percent of 31 to 50 year old women do not meet the suggested intake of meat, poultry, fish, dry beans, and nuts. NHANES data indicates that over five percent of people between 1 and 59 years old have inadequate serum ferritin and over ten percent have low levels of transferrin saturation. The draft implication was that efforts to increase dietary intake of iron-rich foods and enhancers of iron absorption by these populations is warranted.

The members discussed the modeling on folate and whole grains. The fortified grains provide more folate than natural whole grains, but there are other folate sources, and the fiber in whole grains is important. The chapter will have tables illustrating alternate sources of the shortfall nutrients. There was talk of addressing bioavailability in the chapter and looking at the total diet. There was agreement that the folate recommendation should remain where it is, due to its protective effect against neural tube defects.

Member Nickols-Richardson presented on nutrient supplements. The Subcommittee looked at Vitamins and minerals, DHA, and EPA but did not evaluate botanical, hormonal, or performance-enhancing supplements. They looked at single nutrient supplements, functionally related nutrient pairs, and multivitamins. There were four draft conclusions: "For the general, healthy population, there is a lack of evidence on which to base a recommendation for the use of multivitamin/mineral supplements in the primary prevention of chronic disease." "Limited evidence suggests that supplements containing combinations of certain nutrients are beneficial in preventing or reversing chronic disease when used by special populations, such as zinc or zinc plus antioxidant supplements in preventing further age-related macular degeneration in individuals with intermediate or advanced disease." "Certain nutrient supplements appear to be harmful in other subgroups, such as beta-carotene or beta-carotene plus vitamin A supplements in increasing lung cancer risk and mortality among smokers and individuals exposed to asbestos." and "Regulation of multivitamin/mineral and other dietary supplements is lacking such that safety from nutrient toxicity and quality of products cannot be unequivocally assured."

The conclusions were based on an AHRQ systematic review from 2006 that looked at multivitamin and mineral supplements in prevention of 10 chronic disease categories. The review found a lack of RCTs on supplements and disease prevention but did find protective effects for some vitamins and minerals. The 2007 NIH State-of-the-Science Conference on Multivitamin/Mineral Supplements for Chronic Disease Prevention had findings congruent with the AHRQ report and identified limitations to the nutrient supplement studies identified and gaps in the knowledge. A supplement of the *American Journal of Clinical* Nutrition related to omega-3 fatty acids had promising evidence that pregnant and lactating mothers should supplement with DHA for cognitive development of their infants. DHA was also shown to prevent further disease in those with CVD. A further hand search

went back to 2007. The draft implications were that long-term effects on primary prevention of several chronic diseases are poorly defined; people are encouraged to meet overall nutrient requirements within energy levels that balance daily energy intake with expenditure; and the exceptions are folate supplementation among women of reproductive capacity, crystalline B12 supplementation among older Americans, and DHA supplementation in pregnant and lactating women. The Subcommittee's research recommendations support the NIH State-of-the-Science Conference priorities: precision in self-reported intakes; accurate composition and bioavailability data and evaluation of outcomes; and RCTs for primary prevention of chronic disease, including safety and risk assessments.

In brief discussion, Dr. Appel suggested a meta-analysis published in JAMA after the AHRQ report that expanded the list of potential harms of beta-carotene and vitamin E. There was discussion on the size of special populations in the studies. Members discussed the regulations on dietary supplements. Another topic was DHA/EPA supplementation in those with CVD, which was not recommended by the Subcommittee since most of the DHA/EPA studies they reviewed were in mothers and infants. Dr. Nelson suggested a 2008 AJCN paper linking vitamin D and calcium to reduced cancer incidence.

Member Nickols-Richardson presented on behaviors related to nutrient adequacy: breakfast, snacking, and eating frequency. The draft conclusions were, "Some evidence supports a positive relationship between the behavior of breakfast consumption and intakes of certain nutrients in children, adolescents and adults. (Grade II)" and "Very limited evidence supports a positive relationship between snacking and nutrient intakes in children, adolescents, adults, and older adults (Grade III), and inadequate evidence was available to evaluate the relationship between eating frequency and nutrient intakes." The breakfast NEL search went back to 2004 and included 15 studies (eleven cross-sectional, two prospective cohort, one retrospective cohort, and one systematic review). Four were on adults, and the remainder addressed children and adolescents. Those eating breakfast had higher intakes of carbohydrates, fiber, B6, calcium, iron, and magnesium and lower intakes of PUFAs, MUFAs, and trans fats. The snacking NEL review had 7 studies (five cross-sectional studies, one prospective cohort study, and one retrospective study), including studies of adults, children, and adolescents. Those snacking had greater intake of carbohydrates, folic acid, vitamin C, calcium, magnesium, iron, potassium, fiber, and other nutrients. Those snacking had lower intakes of protein, fat, cholesterol, and iron. The eating frequency NEL had three cross-sectional studies, which did not produce enough data to come to a conclusion. The draft implications were to encourage Americans to eat nutrient-dense forms of foods and beverages for breakfast to help achieving nutrient recommendations and if snacking, nutrient-dense forms of foods and beverages were suggested. Some limitations to the questions were that studies were inconsistent in their definitions of "breakfast," "breakfast consumer," "snacking," and "eating frequency;" their intake assessment methods; and the nutrients assessed for. The studies may have been skewed by a bias in favor of publishing studies with positive relationships. The Subcommittee's research recommendations were to form a consensus panel on the definition of "breakfast," "breakfast skipping," "snacking," and "eating frequency;" longitudinal evaluation on the cumulative nutritional risks and benefits of breakfasting, snacking, and eating frequency; and an evaluation of critical components of breakfast and snacks and health effects.

Dr. Appel suggested addressing breakfast consumption by modeling. It is difficult to meet nutrient requirements without breakfast. There was discussion on nutrient dense beverages, and the need for a better definition.

Member Achterberg spoke on the food pattern modeling analysis for starchy vegetables. The modeling addressed two questions: "How do the nutrients provided by the starchy vegetable subgroup compare with those provided by grains and other vegetable subgroups?" and "How would nutrient adequacy of the pattern be affected by considering starchy vegetables as a replacement for some grains rather than as a vegetable subgroup?" The 2005 *Guidelines* increased the suggested number of servings of vegetables, but very few Americans are consuming that level of vegetables. The largest component of the starchy vegetables subgroup is potatoes, and boiled, baked, and fried potatoes make up 80 percent of starchy vegetable consumption. French fries and potato chips make up 37 percent of potato consumption. Starchy vegetables have a macronutrient profile that is more similar to grains than to other vegetables. The modeling analysis compared the nutrient contributions of starchy vegetables to those of other vegetable subgroups and to grains to investigate changes in nutrient patterns if starchy vegetables were considered grain replacements and to find out if the changes were feasible. Two ounces of grain was considered comparable to one cup of starchy vegetables or one cup of fruit. Starchy vegetables were similar in energy content, fiber, magnesium, phosphorus, and niacin to grains but lower in protein, calcium, iron, thiamin, selenium, folate, potassium, and choline. The analysis substituted other vegetable subgroups proportionately for starchy vegetables and reduced grains. Based on a 2000-calorie diet, the largest decreases were in vitamin B12, carbohydrates, selenium, folate, and thiamin. The largest increases were in vitamins K, C, and A. The draft conclusion was, "It is possible to use starchy vegetables as an alternative to grains rather than as a subgroup within the vegetable group, with little impact on nutrient adequacy, as long as additional amounts of other vegetables, including dark green, red-orange, and other vegetables, are used to replace the starchy vegetables counted as grains. These additional vegetables should be substituted equally (1 cup equivalent = 1 cup equivalent) with starchy vegetables that are counted as grains. With this change, the amount of grains (whole and refined) must be decreased by 2 ounce equivalents for each 1 cup equivalent of starchy vegetables." There were a number of draft implications. One cup equivalent of starchy vegetables can replace or substitute for 2 ounce equivalents of grains. For each cup of starchy vegetables that is counted as grains, dark green, red-orange, or other vegetables should be increased by 1 cup to meet vegetable group recommendations. Consumers should not increase intakes of both starchy vegetables and grains. Vegetables and grains selected should be in nutrient-dense forms, rather than forms with added solid fats, sugars, or salt. This model presented an alternative dietary pattern for consumers with an interest in carbohydrate exchanges and would be challenging to implement for most Americans in terms of vegetable consumption. Members discussed increasing the consumption of vegetables, focusing on vegetable subgroups such as green, red, and orange and providing flexibility in meeting the guidelines, as well as making the recommendation clear to consumers.

Member Nickols-Richardson presented on food modeling for plant-based and vegetarian diets. The question was, "How well do plant-based or vegetarian food patterns, adapted from the USDA food patterns, meet IOM Dietary Reference Intakes and potential DG 2010 nutrient recommendations?" The Subcommittee modeled three scenarios: plant-based (more than 50% of all protein from plant sources); lacto-ovo vegetarian (only milk and egg products from animal sources); and vegan (no animal products). The method was to modify the patterns at each calorie level. The

elimination of meat, poultry, and fish meant an increase in nuts, seeds, processed soy, and legumes. Exclusion of dairy meant inclusion of calcium-fortified soy products. For most nutrients, nutrient adequacy was not affected. Protein, zinc, and selenium levels were lower but still adequate. Carbohydrates, fiber, iron, magnesium, vitamin E, folate, potassium, calcium, and vitamin D were higher in vegetarian patterns, though iron bioavailability is lower in vegan patterns. Choline amounts do not meet AI. EPA and DHA amounts were low, but all amino acids met RDA. The base USDA food patterns can be adapted for use as a guide to healthy eating by those wanting to consume more or only plant-based foods with limited impacts on nutrient adequacy, though these patterns may not align with actual vegetarian eating patterns. Choices of plant foods should include foods fortified with vitamin B12, vitamin D, and calcium. Other nutrients that could be of concern include choline, EPA, and DHA. Throughout the presentation on nutrient adequacy, the Subcommittee kept in mind comments from the public asking for flexibility in eating patterns, attention to food processing to produce foods that allow Americans to follow guidelines, and reevaluation of the food groups.

Discussion

Dr. Pearson asked if there would be further modeling on the pregnant and lactating population. Dr. Nickols-Richardson noted that cautions about shortfalls among vegetarians or vegans can be included. Dr Achterberg clarified that counting starchy vegetables as grains was only an option, not a change in the food groups. The different dietary patterns including the vegetarian versions of the USDA patterns will be included and discussed in the Total Diet chapter of the report to provide flexibility and show alternative ways to meet goals.

Alcohol Subcommittee
Chair: Eric Rimm, Sc.D.

Eric Rimm, Chair of the Subcommittee, thanked USDA and HHS staff for their work. The final three questions for the Alcohol Subcommittee were the relationships between alcohol and bone fractures/bone health, unintentional injury, and breastfeeding.

For the first topic, the research question was, “Among persons who consume alcoholic beverages, what is the relationship between patterns of alcohol intake and bone fractures/bone health?” The literature search went back to 1995, including only adults of drinking age. The proposed conclusion was, “There is moderate evidence to suggest a J-shaped association between alcohol consumption and incidence of hip fracture. (Grade II)” Compared with abstinence, consuming one drink a day is associated with lower risk of hip fracture, but at greater than two drinks per day, alcohol consumption is associated with higher risk of hip fracture. This may be due to acute effects on balance and long-term effects on bone density. The search found a systematic review that looked at 33 studies, of which 13 showed the J-shape relationship between alcohol consumption and hip fracture. Four cohort studies showed a linear relationship between femoral neck bone density and alcohol consumption. However, studies often combined moderate and heavy drinkers, so it was impossible to assess a relative association between alcohol consumption and bone density in moderate compared to heavy drinkers. The implications are that there is insufficient evidence related to patterns of alcohol intake and bone health; study limitations frequently included combining moderate and heavy drinkers in the same

category and failing to control adequately for physical activity; and only limited data are available that address changes in markers of bone health in metabolic studies of alcohol consumption.

For unintentional injury, the research question was, "Among persons who consume alcoholic beverages, what is the relationship between patterns of alcohol intake and unintentional injury?" The search went back to 1994, looking at adults of legal drinking age. The proposed conclusion was, "Among persons who consume alcoholic beverages there is substantial evidence to suggest that drinking in excess of current guidelines increases the risk of unintentional falls, motor vehicle accidents, and drowning. Although the evidence for risk of unintentional injury is not as well established when alcohol is consumed in moderation, abstention from alcohol is likely the safest level for occupational activities and other activities such as driving motorized vehicles of any type, swimming, participating in athletics, etc. (Grade I)" The literature review looked at 22 studies. There was clear evidence of unintentional injury at alcohol consumption beyond moderation. The implication was that future research should focus on effective communication policies that reinforce and expand the current messages on drinking and driving to inform individuals of the potential risks of alcohol consumption in the setting of other activities.

For the breastfeeding issue, the primary question was: "What is the relationship between alcohol consumption and lactation? This question was further divided into two sub-questions: 1) What is the relationship between alcohol consumption and the quantity and quality of breast milk available for the offspring? 2) What is the relationship between alcohol consumption and postnatal growth patterns, sleep patterns and/or psychomotor patterns of the offspring?" The literature review looked at adults of legal drinking age and had no date limit. The proposed conclusion for question 1 was, "When a lactating mother consumes alcohol, alcohol enters the breast milk, and the quantity of milk produced is reduced, leading to reduced milk consumption by the infant. (Grade II)" For question 2, the proposed conclusion was, "Limited, but overall insufficient evidence suggests that that alcohol consumption during lactation is associated with post-natal growth sleep patterns and/or psychomotor patterns of the offspring. (Grade III)" For question 1, the conclusion was based on a review of 13 studies, six looking at the effect of alcohol consumption on the quality of the milk, seven looking at quantity. In most cases, less milk was produced, but the normal amount was produced later, when the mother was not drinking. For question 2, the conclusion was based on five studies examining the relationship of the mother's alcohol consumption during lactation and the child's growth, psychomotor development, and wake and sleep patterns. Among children sleeping after breastfeeding, those consuming alcohol do not sleep as well. The evidence on psychomotor development is mixed. The implications were that the level of alcohol in breast milk mirrors the mother's blood alcohol content, so it is not sufficient for a woman to express breast milk after alcohol consumption to prevent exposure to the infant. The benefits of breast feeding to the infant are well established. A woman who chooses to breastfeed, however, need not completely abstain from alcohol. If the infant is of adequate age and a mother chooses to drink, she should wait three to four hours after a single drink before breastfeeding to ensure that exposure of alcohol to the infant is negligible. (The alcohol should be consumed with meals, since this lowers the blood alcohol level.) Alcohol consumption does not enhance lactational performance; it reduces milk production and decreases infant milk consumption in the three to four hours after alcohol is consumed. Although there is

insufficient evidence to conclude that alcohol consumption during lactation affects the postnatal growth of the child, a breastfeeding infant should not be exposed to alcohol.

Discussion

Member Achterberg asked about binge drinking versus other intake patterns, with regard to bone health. Dr. Rimm said that the Guidelines already advise against binge drinking, and that unintentional injuries are associated with excess drinking, sometimes below binge drinking levels. Dr. Pi-Sunyer asked about drinking before a meal versus drinking during a meal. Dr. Rimm replied that the effects were similar in terms of blood alcohol level. Dr. Van Horn suggested comparing alcohol calories for adults to added sugar calories for children; she asked about incorporating alcohol into a proper diet within energy limits, as well as how drinking affects diet quality. Another topic was comparison of alcohol to caffeine in terms of time necessary for it to leave breast milk. As the *Dietary Guidelines* continue, the Committee members agreed that it will become necessary to look at many other mother/child dietary issues.

Sodium, Potassium, and Water Subcommittee
Chair: Larry Appel, M.D., M.P.H.

Larry Appel, Chair of the Subcommittee, acknowledged the Subcommittee members and staff. The topics for the presentation were sodium modeling, potassium intake and blood pressure, potassium modeling, conclusions and implications of water intake and health, and adjustment of sodium and potassium recommendations by energy intake.

The objectives of sodium modeling were to document the relationship of sodium and energy intakes and to describe sodium levels of the UDSA food patterns under three scenarios: base condition, typical condition (typical food choices), and lowest sodium foods (if the lowest sodium foods are chosen). Across the population, for men and women, dietary sodium exceeds the recommended limit. Sodium is tied to energy intake. He demonstrated the difference between USDA food patterns, DASH, and actual intake according to NHANES, which was much higher. People can make bad choices within the food groups that will result in sodium intake higher than NHANES data or choose well and have sodium intake lower than with a reduced-sodium diet. Sodium in base USDA food patterns is about 40 percent lower than current intakes, close to 2300 mg at 2000 kcal. With careful selection of foods, sodium intake can be reduced to 1500 mg at 2000 kcal, about 70 percent below current intake.

The first question was, “What is the effect of sodium intake on blood pressure in children and in adults?” The draft conclusion was, “A persuasive body of evidence has documented that in adults, as sodium intake decreases, so does blood pressure. (Grade I) A large body of evidence has also documented a similar relationship in children, birth to 18 years. (Grade II)” The data for this conclusion was presented at the previous meeting. There were several implications. A daily sodium intake of less than 2,300 mg is recommended for the general adult population and an intake of 1,500 mg for hypertensive individuals, blacks, and middle- and older-aged adults. Because these groups make up nearly 70% of US adults, 1,500 mg should be the goal in the general population. The marketplace makes this a challenging but compelling public health goal. All individuals should concurrently increase their consumption of potassium, since potassium attenuates the effects of

sodium on blood pressure. The health benefits of a reduced sodium intake include fewer strokes, cardiovascular disease, and deaths, as well as substantially reduced healthcare costs. Children and adults should reduce their sodium intake as much as possible by consuming less processed foods and preparing foods with little or no sodium. The current food supply is replete with excess sodium. An emerging concern is the addition of sodium to poultry, pork and fish in the form of injections, marination, or surface sprays in which quantification of sodium content is scant and evidently not regulated. Because sodium intake is tightly linked to calorie intake, reducing calorie intake should also lower sodium intake. The high impact issues were to set sodium goals for adults and children. For adults, the goal is to incrementally lower the goal from 2,300 mg to 1,500 mg. Children should also consume diets reduced in sodium intake. The research recommendations were to conduct studies, including clinical trials, in children to determine the effects of sodium on blood pressure and the age-related rise in blood pressure and to conduct trials that determine the effects of sodium reduction on clinically relevant non-BP variables, such as left ventricular mass, proteinuria, and bone mineral density.

In discussion, Dr. Clemens pointed out that, for some products, brining is required by regulation and for safety. The members discussed labeling for brined products. The issue is whether or not the sodium content is reported at the proper level as consumed. There is a requirement that any product with two or more ingredients reflect the ingredients on the statement, including solutions in meat and poultry. Dr. Fukagawa suggested a recommendation to soak brined meat in order to remove the sodium or rinsing and to make consumers aware of brining.

Member Appel moved on to potassium, for which the first question was, "What is the effect of potassium intake on blood pressure in adults?" There was no date limit on the literature search, which focused on RCTs. There were several systematic reviews and meta-analyses that concluded that blood pressure (BP) goes down as potassium goes up. The draft conclusion was, "A considerable body of evidence has documented that a higher intake of potassium is associated with lower blood pressure in adults. (Grade I)" The implications were that diets rich in potassium can lower blood pressure, a high intake of potassium attenuates the adverse effects of sodium on blood pressure, and other possible benefits include a reduced risk of developing kidney stones and decreased bone loss. (The third implication is from the 2005 *DRI* report.) Further implications are that increased dietary intake of potassium is warranted; only six percent of men and fewer than three percent of women met or exceeded the IOM AI (4,700 mg) for potassium amount in 2001-02; less than three percent of children met the IOM AI; and available evidence suggests that blacks and hypertensive individuals especially benefit from an increased intake of potassium.

The Subcommittee conducted potassium modeling based on two questions: "What is the relationship of potassium and energy intakes in the US?" and "How would the potassium levels of the USDA food patterns change if an assumed amount of coffee and tea, based on current intake levels, were to be added?" Generally, potassium intake increases with energy intake, but not as closely as with sodium. He pointed out that if 18 ounces of coffee or tea per day were added to the model, it would provide an additional 247 mg of potassium. The Subcommittee recommended trials on whether increased potassium intake or potassium-rich foods increase bone mineral density and dose-response trials to test the main and interactive effects of sodium and potassium intake on BP and other clinically relevant outcomes. The members discussed whether the types of tea affected potassium content.

Member Appel suggested wider application of energy adjustment, which has been done for sodium in children and older adults and for potassium in children but has seen inconsistent application to other nutrients such as fiber and proteins. It is reasonable that other nutrients will be applicable to energy adjustment. Dr. Pearson noted that energy adjustment applies to cholesterol. The members discussed linking more nutrients to calorie-adjusted DRIs, as well as the problems related to food labeling and making recommendations. There was a question of whether high levels of cholesterol and sodium are healthy, even at high-energy levels of intake. The Committee decided to wait for the IOM report, which will address many translational issues.

Member Appel addressed the next research question: "What amount of water is recommended for health?" The draft conclusion was, "Based on an extensive review of evidence, an IOM panel in 2004 concluded that the combination of thirst and usual drinking behavior, especially the consumption of fluids with meals, is sufficient to maintain normal hydration. However, because water needs vary considerably and because there is no evidence of dehydration in the general population, a minimum intake of water cannot be set." There is little new evidence since the IOM and DRI reports. The implications are, in order to prevent dehydration, water must be consumed daily; healthy individuals with 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; and individuals are encouraged to drink water and other fluids with few or no calories. The research recommendation was to investigate the role of increased total fluid intake as a means to prevent chronic diseases, such as bladder cancer and kidney stones.

The members discussed that there is evidence that there is not a dehydration problem and whether or not the evidence requires grading. General consensus was that it did not. Dr. Clemens raised the issue of hyperhydration, which occurs, but seldom in the general population. It can be addressed in a couple sentences in the chapter. Dr. Slavin mentioned the popular misconception that drinking water causes weight loss, for which the Subcommittee found no evidence.

Member Appel listed several public comments that the Subcommittee considered and discussed in their work. The Subcommittee has completed its chapter and is in the editing phase.

Food Safety and Technology Subcommittee
Chair: Roger A. Clemens, Dr.PH.

Roger Clemens, Chair of the Subcommittee, thanked the Subcommittee members and staff and gave the floor to Dr. Perez-Escamilla.

Member Perez-Escamilla spoke on in-home techniques and behaviors for food safety. The overarching question was, "What behaviors are most likely to prevent food safety problems and to what extent do US consumers follow these behaviors?" There were three sub-categories organized to follow the principles of FightBAC!®: clean, separate, and cook and chill. The Subcommittee's conclusions were based on the literature search on consumer behavior and favorable techniques, which went back to 2004 and estimates from the 2006 FDA/FSIS Food Safety Survey.

The first sub-question under the category of cleaning was, "What techniques for hand sanitation are associated with favorable food safety outcomes and to what extent do US consumers follow them?" The proposed conclusion was, "Clear and consistent evidence shows that, hand washing with plain soap for 20-30 seconds followed by proper hand drying is an effective hand hygiene technique for preventing cross-contamination during food preparation. (Grade 1)" Alcohol-based hand sanitizers are adequate when soap and water is not available. Antimicrobial soap is not needed for proper hand-washing at home and should be avoided due to possible microbial resistance. The conclusion was based on 17 studies. The proposed conclusion to the second part of the question was, "Consistent evidence shows that US consumers are not following proper hand sanitation techniques. (Grade II)" This conclusion was based on six cross-sectional studies, including the FDA/FSIS survey.

The second research question on cleaning was, "What techniques for fresh produce washing are associated with favorable food safety outcomes and to what extent do US consumers follow them?" The first proposed conclusion was, "Evidence based on a limited number of studies has shown that proper washing of vegetables and fruit at home or under laboratory simulation conditions to be associated with reduced produce microbial loads. (Grade II)" The evidence was based on two randomized trials, one cross-sectional study, and the FDA/FSIS survey. The proposed conclusion to the second half of the question was, "Limited evidence shows that US consumers are not following proper produce washing techniques. (Grade III)" This was based on two cross-sectional studies and the FDA/FSIS Survey. The Subcommittee's research recommendation was to examine the link between different washing techniques on diverse outcomes including microbial and pesticide loads in diverse food products.

The third research question on cleaning was, "To what extent do US consumers clean their refrigerators following current recommendations?" The proposed conclusion was, "Consistent evidence shows that US consumers do not clean their refrigerators following current recommendations. (Grade II)" This was based on four cross-sectional studies.

The next question was on separating: "What techniques for cross-contamination prevention are associated with favorable food safety outcomes and to what extent do US consumers follow them?" The proposed conclusion was, "Consistent evidence indicates that preventing cross-contamination in the home kitchen may reduce exposure to foodborne pathogens among US consumers. (Grade II)" The conclusion was based on thirteen studies. The Subcommittee recommended future research to understand if and how home kitchen microbial cross-contamination during food preparation translates into actual risk for foodborne illness and to examine the application of Hazard Analysis and Critical Control Points (HACCP) principles at the household level.

The next question was on the topic of cook and chill: "To what extent do US consumers follow adequate temperature control during food preparation and storage at home?" The proposed conclusions were, "Consistent evidence shows that the great majority of US consumers do not use food thermometers to properly assess the internal cooking temperature of meats while cooking. (Grade 1)" and "Consistent evidence shows that US consumers lack refrigerator and freezer thermometers in their homes. (Grade II)" The food thermometer conclusion was based on one systematic review and six cross-sectional studies. The refrigerator and freezer thermometer review was based on the FDA/FSIS survey and two cross-sectional analyses.

The next cook and chill question was, "To what extent do US consumers ingest raw or undercooked animal-source food products?" This was identified as "risky foods" in the *2005 DGAC Report*. The proposed conclusion was, "Clear and consistent evidence shows that the consumption of raw or undercooked animal-source food products is common in the US, especially for eggs and egg-containing products. (Grade II)" The conclusion was derived from eight studies: one meta-analysis, one systematic review and six cross-sectional studies. The Subcommittee recommended research to quantify the health risks associated with the consumption of raw or undercooked animal source products.

The last question on practices addressed special populations: "To what extent do pregnant women, college student and older adults practice unsafe food safety behaviors?" The proposed conclusion was, "The evidence reviewed by the Committee shows that pregnant women, college students and older adults commonly practice unsafe food handling and consumption behaviors. (Grade II)"

The Subcommittee recommended that there be future research to improve the validity of self-reported food safety behaviors; understand how to improve consumers' food safety knowledge, attitudes, self-efficacy, internal locus of control and, ultimately, behaviors; improve monitoring and surveillance to better understand the epidemiology of home-based foodborne illness outbreaks; and examine the application of HACCP principles at the household level.

Dr. Appel suggested a research recommendation for information dissemination strategies, especially since so many people were never taught how to cook. Members discussed returning cooking lessons to schools.

Member Perez-Escamilla addressed the question, "What are the benefits in relationship to the risks of seafood consumption?" The 2004 EPA/FDA advisory recommends women of reproductive age avoid consumption of large predatory fish, limit albacore (white) tuna consumption, and set weekly limits of seafood consumption. However, there is uncertainty in the public about the risks, and the public is confused. The recommendations in the 2004 EPA/FDA advisory do not extend beyond the subpopulations targeted, providing no guidance for the general public. The Subcommittee's proposed conclusion was, "Consistent evidence shows that health benefits derived from the consumption of a variety of cooked seafood in the US in amounts recommended by the Committee outweigh the risks associated with methyl mercury (MeHg) and persistent organic pollutants (POPs) exposure, even among vulnerable populations. Overall, consumers can safely eat up to 12 ounces of a variety of cooked seafood per week provided they pay attention to local seafood advisories and limit their intake of large, predatory fish. Women of reproductive age who are pregnant or nursing and children ages 12 and younger should avoid large, predatory fish." The implication of the findings was that seafood is a healthy food choice that can be safely promoted, provided that the types and sources of seafood to be avoided are clearly communicated to consumers. This conclusion was based on three quantitative risk/benefit assessments, four cross-sectional studies, one meta-analysis, one systematic review, and the *IOM Seafood Choices* 2007 report. In general, the assessments took into account methyl mercury and POPs as well as the benefits of omega-3 PUFAs. As addressed at the November meeting, consumers can obtain the omega-3 PUFAs without exceeding tolerable levels of methyl mercury if they choose the right mix of seafood. The Subcommittee recommended future consumer risk communication research to determine how to

best translate the seafood benefit/risk findings to the public; research to further refine seafood intake recommendations for US consumers; research to improve current seafood consumption surveillance and monitoring; and research to monitor food safety of seafood produced via aquaculture.

There was discussion on large predatory fish, which are not consumed in large quantities in the US The main problem is communication. On average, 94 percent of the fish consumed in the US are not an issue. The members discussed aquaculture and safety. Dr. Perez-Escamilla said the US is trying to become more proactive in monitoring standards of foreign aquaculture.

Member Clemens addressed food technology. The first question was, "To what extent are recently developed technological materials, which are designed to improve food safety, effective in reducing exposure to pathogens and decreasing the risk of foodborne illnesses in the home?" The proposed conclusion was, "Three randomized block studies, one cross-sectional descriptive study, and one case-control study evaluated a) the accuracy and reliability of several types of home thermometers, b) the effectiveness of antibacterial products, including wipes, food contact surfaces and sanitizers. These small studies indicate that the correct usage of these kinds of products is critical for assessing proper cooking temperature and assuring adequate reduction of microbial burden on food contact surfaces. Not all thermometers tested, wipes assessed, and sanitizers evaluated were accurate or effective in providing correct cook temperatures (potential of over cook or under cook) or in assuring consistent safety against typical foodborne organisms. (Effectiveness of sanitizers was surface and organism dependent.) (Grade III)"

The second question was, "To what extent are recently developed technologies effective in increasing the shelf life of foods?" No evidence was found in the peer reviewed literature, so no conclusion could be proposed.

The last question was, "Which recently developed, effective technological materials (designed to improve food safety or increase shelf life) are accessible, cost-effective, and acceptable to recommend to consumers?" Again there was no peer-reviewed literature, so no conclusion could be proposed, though the Subcommittee will look into the cost of thermometers. Dr. Rimm commented that many technologies, such as irradiation of beef, are done outside of the home. Members said safe food handling practices are important for industry and in the home. Members discussed safe practices for secondary prevention as well as health extension services. Consumers should know that microwave ovens are not sterile devices or sterilizing devices.

Comments from the Chair

Chair Van Horn said there will be two additional chapters in the report: the Total Diet chapter, which will take all the information and put it into an eating pattern that involves all the food groups and meets nutrient adequacy without exceeding caloric needs, and a Translation and Integration chapter, which will address implementing eating patterns on the basis of the environmental issues and looking for additional effort, support and research to look at how Americans should go about choosing, cooking, and eating foods to meet nutrient requirements.

Dietary Patterns Subcommittee
Chair: Larry Appel, M.D., M.P.H.

Larry Appel, Chair of the Subcommittee, thanked the Subcommittee members and staff. His presentation covered dietary patterns, the description of the dietary patterns, health benefits, and issues for discussion. The first research question was, "What is the effect of different dietary patterns (including DASH diet, Mediterranean diet, Vegetarian diet, Okinawan diet) on blood pressure in adults?" The draft conclusion was, "Several distinct dietary patterns lower blood pressure." The NEL search did not have a date limit. 21 studies were included: 16 RCTs and five prospective studies. The largest number of studies were on the DASH Diet (14), followed by the vegetarian diet (4). There was one study on the Mediterranean diet. All of the diets were associated with lower blood pressure.

The next question was, "What is the effect of different dietary patterns (including DASH diet, Mediterranean diet, Vegetarian diet, Okinawan diet) on cardiovascular disease, stroke, and total mortality in adults?" Again, the literature search had no date limit. There were 43 studies included, 34 of which were prospective cohort studies. The studies covered the Mediterranean diet, DASH and variants, vegetarian, and other/mixed. The majority of the studies documented benefits on total mortality and CVD. The Subcommittee has not yet drafted a conclusion but is likely to conclude that several distinct dietary patterns are associated with reduced risk of CVD.

The Subcommittee found it difficult to describe the dietary patterns in terms that describe the types of food groups and nutrients that are provided in the dietary patterns due to the heterogeneous presentation of the studies. The various diets show great variation in nutrients and methods of measurement. The Subcommittee will try to establish more uniform and comparable data in the final version. They will then develop summary tables for dietary patterns and health outcome tables for the diets. The Subcommittee will develop research recommendations, one of which will be on how to synthesize results from the different types of studies.

Discussion

Member Rimm commented that the Okinawan diet is proprietary and may not be relevant to the US population. He also suggested the *Healthy Eating Index* as a pattern of adherence and for comparison with other dietary patterns. Dr, Appel said the Okinawan and Japanese diets exist in Japan independent of the publication of the diet plan, and there are many benefits to the diet. Dr. Van Horn noted that the Okinawan diet is 85 percent carbohydrates, and none of the dietary patterns would make a perfect recommendation. She suggested a greater emphasis on shortfall nutrients, such as dietary fiber.

Translation and Integration Chapter
Naomi Fukagawa, M.D. Ph.D.

Naomi Fukagawa, Vice Chair of the DGAC, acknowledged the staff and members. The purpose of this chapter will be to identify cross-cutting issues that have come out in the chapter reviews. The chapter will synthesize the disparate findings and narrow them down to key points about what the evidence is saying about diet and health. The Subcommittee has tentatively identified four primary points: to address the issue of the incidence and prevalence of overweight and obesity in the US; to reconcile issues regarding added sugars, solid fats, refined grains, and sodium in the diet and relate

the issues to consumer behavior, food policies, and issues of food production and safety; whether or not to consider recommending a shift in food intake patterns in order to achieve better health for the nation while still dealing with the variety of differences we have culturally, ethnically, and with lifestyle and food preferences; and trying to encourage Americans to adhere to and meet the 2008 *Physical Activity Guidelines*. Committee members will be meeting over the next few weeks to address these issues.

Member Nelson commented that if there were to be a recommended shift in food intake, it would be toward a more plant-based diet. She added that the translational piece will focus on a coordinated strategic plan for meeting the targets. There will have to be multi-sector changes to make actual change in food intake patterns. Changing the overall food environment would make it easier for people to meet the *Guidelines*.

Next Steps

Chair Van Horn said each Subcommittee will finalize the conclusion statements in response to feedback at the meeting. The Subcommittee chairs will lead drafting of the content of the chapters and work with the science writer on the organization and flow within and between the chapters, as well as contributing to the Total Diet and Translation Integration chapters.

The last meeting will be on May 12, after the entire report has been drafted. After coming to consensus on the report, there will be final formatting and submission of the report to the Secretaries of USDA and HHS, who will post it for public comment. She thanked the participants.

Dr. Post thanked the Committee and said he looks forward to continued work with the Committee. He recognized USDA and HHS staff for their work and adjourned the meeting.

(Adjournment 4:00 p.m.)