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INSIDE

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Nutrition Close-Up is a quarterly publication of the American Egg Board, written and produced by the Egg Nutrition Center. *Nutrition Close-Up* presents up-to-date reviews, summaries and commentaries on the latest research on the role of diet in health promotion and disease prevention, including the contributions of eggs to a nutritious and healthful diet. Nutrition and health care professionals can receive a **free** subscription for the newsletter by contacting the Egg Nutrition Center.

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Celebrating 25 years of nutrition research and health education (1979-2004)

Whole Grain Intake and Insulin Sensitivity

According to the Dietary Guidelines for Americans, individuals should "aim for at least 6 servings of grain products per day…and include several servings of whole grain foods." While refined grain products abound in the typical American diet (think of the bagels, muffins, and danishes on the breakfast buffet), the average estimated intake of whole grain products among Americans is a mere 0.9 to 1.1 servings per day. Whole grain products including dark breads, cooked oatmeal, and high-fiber cereals like shredded wheat are becoming increasingly nostalgic. Our times are marked by the ever-increasing prevalence of the metabolic syndrome, characterized by overweight and obesity, abdominal adiposity, high triglycerides, high blood cholesterol, hypertension, elevated blood sugar, and insulin resistance. This cluster of symptoms puts an estimated 47 million Americans at increased risk for type 2 diabetes which is steadily increasing in the population. Is there a connection between whole grain intake and diabetes mellitus? Available data suggest that whole grain intake is associated with a reduced risk of diabetes mellitus. Improved insulin sensitivity with whole-grain intake is one plausible explanation for this relationship. This hypothesis has prompted several controlled studies dedicated to clarifying the relationship—if one exists—between whole grain intake and insulin sensitivity.

One such study, conducted by Liese et al., utilized information from the multicenter Insulin Resistance Atherosclerosis Study (IRAS) to examine the relationship between whole grains and glycemic response. Data for 978 middle-aged individuals (45% male, 55% female) with normal or impaired glucose tolerance were evaluated. (Because there were no significant differences between these groups, data for all participants were combined for the final analysis regardless of glucose tolerance status.) Each participant was visited twice, once to obtain samples for determination of glucose tolerance status, and once to measure insulin sensitivity (IS).

Information about the intake of whole-grain and other nutrients was obtained by administration of a 114-item food-frequency questionnaire (FFQ). Participants were asked to report intake patterns based on their dietary habits for the previous year. Whole grain foods were identified in three categories: 1) "dark bread (including whole wheat, rye, pumpernickel, other high-fiber bread)"; 2) "high-fiber bran or granola cereals, shredded wheat"; and 3) "cooked cereal (including oatmeal, cream of wheat, and

Continued on page 2

Continued from page 1

grits)." Serving sizes were reported as small, medium, or large. (Participants rated serving sizes compared to those consumed by others of the same age and sex.) Intakes of dietary fiber, magnesium, and zinc were also estimated for inclusion in the final analysis to evaluate the influence of individual nutrient components of whole grains.

Average age of participants was 54.8 ± 8.5 years. Non-Hispanic white participants made up 39.9% of the cohort, while 34.0% were Hispanic and 26.1% were African-American. Participants with at least one first-degree relative with type 2 diabetes made up 39.6% of the study group. Current smokers made up 16.2% of the study group.

On average, the participants consumed 0.8 ± 0.7 servings of whole grains per day, dark breads accounting for 0.6 ± 0.6 servings, high-fiber cereals accounting for 0.2 ± 0.3 servings, and hot cereals accounting for 0.1 ± 0.2 servings per day. After controlling for age, sex, ethnicity, and total daily calorie consumption, intake of whole grains was significantly associated with higher IS. Although adjustment for BMI and waist circumference weakened this association, these factors could account for only part of the effect. Of the nutrients found in whole grain that were expected to play a beneficial role, only fiber and magnesium contributed significantly to the association between whole grains and IS. Fiber and magnesium were independent predictors of IS ($P=0.047$ and $P=0.015$, respectively). Whole-grain intake was not significantly associated with lower fasting insulin concentrations after adjustment for BMI and waist circumference.

To shift the emphasis from a strict evaluation of nutrients and food components, Liese et al. also evaluated the effects of individual foods. High-fiber cereals and dark breads were significantly and positively associated with IS, while increased intake of both was associated with lower fasting insulin levels. Cooked cereals were not significantly associated with either IS or fasting insulin.

Results from the IRAS study indicate that consistent intake of foods high in whole grains—such as high-fiber cereals and dark breads—is associated with improved IS. While it appears that fiber and/or magnesium might have been individually responsible for a portion of the observed effect on IS, they did not account for the entire effect of whole-grain intake. Other properties of whole-grain foods (such as the unaltered structure of whole grains) warrant further research. Since decreased insulin sensitivity is an integral component of the metabolic syndrome and because the metabolic syndrome is a common precursor to type 2 diabetes, the implications of these findings extend to possible applications in diabetes prevention.

Mirroring the rise in incidence of type 2 diabetes among adults is an alarming increase of the disease among children and adolescents, especially for those of American Indian descent. Type 2 diabetes appears to be on the rise among other ethnic groups as well. One research group reported that for African-American and Caucasian children in Cincinnati, Ohio, ages 10-19, 33% of those diagnosed with diabetes mellitus were classified as having type 2. What used to be seen as an adult disease has now attacked America's youth, putting them at risk for early cardiovascular disease along with other diabetic complications. To evaluate the potential benefits of whole grain intake in this population, Steffen et al. examined the effects of dietary intake on insulin sensitivity, BMI, and cardiovascular risk factors in fifth, sixth, seventh, and eighth graders in Minneapolis, Minnesota.

Data sets were examined from a sample of 285 children and adolescents (155 boys and 130 girls) who had previously undergone two euglycemic insulin clamp studies (to determine insulin sensitivity) and dietary analyses. The insulin clamp studies were conducted two years apart and food frequency questionnaires were completed by participants at these timepoints. Participants also completed physical activity questionnaires. Height, weight, BMI, triceps and subscapular skinfolds, and waist circumference were measured for each child. Tanner stage was determined by a pediatrician. Blood glucose, serum lipid levels (including HDL, LDL, and triacylglycerol concentrations) were also obtained.

Adolescents and their parents were interviewed using the 127-item Willett food frequency questionnaire, with seven categories including meat, fish, poultry, fruit, vegetables, dairy foods, whole grains, and refined grains. Participants were also surveyed about the type of breakfast cereal they regularly consumed, other frequently eaten foods, and use of vitamin supplements. Foods classified as whole-grain included cooked oatmeal, dark breads, bran, wheat germ, popcorn, brown rice, other grains such as bulgur, kasha, and couscous, and breakfast cereals containing at least 25% whole grain or bran by weight. Refined-grain foods included white breads, bagels, rolls, muffins, pasta, white rice, pancakes, waffles, doughnuts, cake, cookies, bars, pies, and breakfast cereals containing less than 25% whole grain or bran by weight.

Within this group of adolescents, 86% were Caucasian and 14% were African-American. Although the average BMI for boys and girls was similar (22.9 and 22.4, respectively), boys carried more lean mass than girls, as would be predicted in this adolescent sample. The average macronutrient distribution for both boys and girls was 55% carbohydrate, 15% protein, and 30% fat. Average consumption data revealed that intake of iron, zinc, folate, and vitamin E was adequate among these boys and girls. The

Continued from page 2

girls fell only slightly short of reaching the Dietary Reference Intake (DRI) for calcium (1240 mg/day vs. DRI of 1300 mg/day), while the boys exceeded the DRI for calcium.

Adolescents were classified by servings of whole-grain consumed per day into three categories: 1) less than ½ serving/day; 2) ½-1 ½ servings/day; and 3) more than 1 ½ servings/day. Because calcium intake was similar across the three whole-grain categories, it is reasonable to assume that calcium intake did not contribute to any observed differences between groups. Refined grain intake was also similar across categories, while meat consumption decreased and fruit and vegetable intake increased with increasing whole grain consumption. Reported levels of physical activity along with intake of iron, zinc, calcium, folate, and vitamin E were also positively related to whole grain consumption.

Because there were consistent fluctuations in insulin resistance throughout adolescence, analyses included adjustment for Tanner stage. Statistical analysis revealed an inverse association between BMI and insulin sensitivity (r=-0.20; p=0.001) and a weak inverse correlation between BMI and whole grain intake (r=-0.14; p=0.01). There was a direct—though small—correlation between intake of whole grains and insulin sensitivity (r=0.18; p=0.004). Both BMI and waist circumference decreased across rising tertiles of whole grain consumption. Moreover, fat mass was determined to be responsible for the majority of the difference in BMI, indicating that lower intake of whole grains is associated with greater adiposity. Blood lipid profiles, blood pressure, and triglycerides remained essentially unchanged across tertiles of whole grain intake.

After adjusting for BMI and physical activity, there was a direct dose-response relationship between insulin sensitivity and whole grain intake (p=0.01). The stronger relationship between whole grain intake and insulin sensitivity among adolescents with higher BMIs (particularly among those with BMIs > 27.5) is also worth noting. It appears that whole grain consumption might be most beneficial for those at greatest risk.

Data from this study mirrors the results reported by Liese et. al. in an adult population. Overall, whole grain intake appears to have an independent effect on insulin sensitivity and, thus, might have the potential to protect against the development of type 2 diabetes mellitus. However, associations between whole grain consumption and physical activity, as well as higher intake of fruit, vegetables, fiber, iron, zinc, calcium, folate, and vitamin E (Steffen et al.) indicate that these healthy lifestyle components work synergistically and might contribute heavily to the observed effect. Further research would be necessary to determine the relative influence of each of these factors.

Liese AD, Roach AK, Sparks KC, et al. Whole-grain intake and insulin sensitivity: the Insulin Resistance Atherosclerosis Study. *Am J Clin Nutr* 2003;78:965-71.

Steffen LM, Jacobs DR, Murtaugh MA, et al. Whole grain intake is associated with lower body mass and greater insulin sensitivity among adolescents. *Am J Epidemiol* 2003;158:243-250.

Key messages

- A positive, dose-response relationship appears to exist between whole-grain intake and insulin sensitivity.
- High-fiber cereals and dark breads appear to help increase insulin sensitivity and decrease fasting insulin levels.
- Whole-grain consumption is associated with lower BMI and smaller waist circumference in adolescents.

COMMON ABBREVIATIONS

BMI: body mass index (kg/m^2)
CHD: coronary heart disease
CHO: carbohydrate
CVD: cardiovascular disease
HDL: high density lipoprotein
LDL: low density lipoprotein
Lp(a): lipoprotein (a)
MUFA: monounsaturated fatty acids
PUFA: polyunsaturated fatty acids
PVD: peripheral vascular disease
RR: relative risk
SFA: saturated fatty acids
TAG: triacylglycerol
VLDL: very low density lipoprotein

Dietary Protein and Glycemic Control:

Increased Dietary Protein Improves Blood Glucose Control in Type 2 Diabetes

High-protein diets have had a hard time keeping a low profile in the scientific and popular press as of late. These seeming antitheses to the conventional diets most often prescribed by physicians and dietitians have demanded more attention as they have moved into the research setting. When compared with their high-carbohydrate, low-fat counterparts, higher-protein diets have generally performed well in terms of changes in body weight, blood lipid profiles, and satiety. However, many of the individuals likely to be interested in high-protein diets for weight loss are those with complications secondary to overweight, such as type 2 diabetes mellitus. Protein has been shown to potentiate the insulin response elicited by carbohydrate. What consequences might be in store for diabetic individuals following higher-protein diets? To assess the risks and potential benefits of increased protein intake within this population, researchers at the University of Minnesota, Minneapolis and at the Veterans Affairs Medical Center in Minneapolis studied the effects of this kind of dietary intervention on blood glucose responses in 12 participants with mild, untreated type 2 diabetes.

Ten men and 2 women, ages 39 to 79, were recruited to participate in this randomized crossover study. The mean body mass index for this group was 31, with percent total glycosylated hemoglobin (a standard measure of glycemic control) ranging from 7.0% to 9.3% (mean of 8.0%). None of the participants were being treated with hypoglycemic medications or with insulin therapy. Participants followed the experimental or control diet for a period of five weeks (equivalent to the half-life of glycosylated hemoglobin). The change to the alternate diet was preceded by a 2-5 week washout period.

The control and high-protein (HP) diets were isocaloric and were not meant to induce weight loss. Weight maintenance was the goal for all participants over the course of the study to control for alterations in glycosylated hemoglobin and other biochemical markers that might be elicited by changes in body weight.

Macronutrient distributions for each diet were defined as follows:

	Control	HP
Protein	15%	30%
CHO	55%	40%
Fat	30%	30%

Although the control diet emphasized starchy carbohydrate choices, its macronutrient distribution was patterned after recommendations from the American Diabetes Association, the American Heart Association, the US Department of Agriculture, and the American Cancer Society. The percent calories from fat (30%) and fatty acid distribution (10% monounsaturated, 10% polyunsaturated, and 10% saturated) were held constant in both diets to clarify the effects of differing proportions of protein and carbohydrate. The diets were also similar in fiber content.

To begin the study, all participants were randomly assigned to the high-protein or control diet. Following admission to the study treatment unit, all participants were fed a standardized meal pattern containing 55% carbohydrate, 30% fat, and 15% protein for 2 days. On the morning of the second day, blood samples were obtained from each participant for baseline lipid analysis. During the second day of standardization, blood samples were obtained following meals and snacks to determine postprandial glucose concentrations. All meals were provided to participants at 2-3 day intervals and participants were expected to eat all of the food provided. Dietary compliance was determined by analysis of urine samples provided at the time of meal pick-up. Weight, blood pressure, and glycosylated hemoglobin were also measured at these time points.

At the conclusion of the first five weeks of the study, participants were admitted to the treatment unit where blood was again drawn following meals and snacks to monitor changes in postprandial blood glucose concentrations. Participants then underwent a 2-5 week washout period in which they followed the control diet specifications before beginning the final five weeks on the alternate (control or HP) diet. Participants were again admitted to the treatment unit after the final five weeks and the same protocol was used to monitor changes in postprandial blood glucose concentrations.

Body weight did not change significantly for participants in either diet group. None of the participants in either group lost or gained more than 2 lbs over the course of the study. Compliance, as determined by analysis of the urine samples, was excellent for both diet groups. While the mean fasting glucose concentration did not change significantly following five weeks of either diet, postprandial glucose concentration was consistently lower when measured following meals and snacks on the final day of the HP diet. The mean 24-hr integrated glucose area response was also lower after the HP diet regimen (21.0 ± 4.2 mmol x h/L vs. 34.1 ± 7.2 mmol x h/L; $p<0.02$).

Mean percent glycosylated hemoglobin decreased following 5 weeks of the HP diet (8.1 ± 0.3% to 7.3 ± 0.2%). The decrease following the control diet was not statistically significant (8.0 ± 0.2% to 7.7 ± 0.3%). Creatinine clearance and microalbumin were similar indicating that there were no changes in kidney function

Continued from page 4

as a result of increased dietary protein and decreased carbohydrate over 5 weeks.

The scientific scrutiny under which higher-protein diets have recently been placed has resulted in mostly favorable outcomes, for which they have earned their place among popular research topics. Little is known, however, about the long-term effects of such diets. Given the comorbidities associated with diabetes, including nephropathy, the results of this study have limited immediate application. However, higher-protein diets have tremendous potential if long-term studies show continued favorable effects on blood glucose concentrations and no negative effects on markers of kidney function. Gannon et al. showed no short-term negative effects on kidney function as assessed by creatinine clearance and microalbumin levels, however, this topic warrants further research, especially in diabetic populations. The short-term effects of higher-protein diets demonstrate great potential in improving glycemic control and blunting the postprandial rise in blood sugar.

Gannon MC, Nuttall FQ, Saeed A, et al. An increase in dietary protein improves the blood glucose response in persons with type 2 diabetes. *Am J Clin Nutr* 2003;78:734-41.

Comment

According to the Institute of Medicine (IOM), Acceptable Macronutrient Distribution Ranges (AMDRs) for adults are 20-35% for fat, 45-65% for carbohydrate, and 10-35% for protein. Although slightly lower in carbohydrate, the "high-protein" diet utilized as the intervention regimen in this clinical trial falls well within—though in the upper end of—what the National Academies endorses as a healthy range for protein intake. So before discounting the results because of potential health hazards, it must be acknowledged that the higher-protein diet pattern utilized in this clinical trial is not the extreme low-carbohydrate or high-fat regimen often associated with high-protein diets.

Trans-Fat Intake Correlates with LDL Particle Size

Elevated LDL cholesterol has long been known to contribute to the development of cardiovascular disease (CVD). However, the size of LDL cholesterol particles has only recently been recognized as a significant factor in determining the risk associated with elevated LDL. In fact, LDL particle size has been shown to be an independent predictor of CVD risk. Smaller, denser particles pose a greater threat than the larger, less dense variety. *Trans*-fatty acids—formed during the hydrogenation process used to solidify and stabilize vegetable oils—have been shown to increase LDL cholesterol levels and are thought to raise CVD risk through other mechanisms as well. Little is known, however, about the effect of *trans*-fat intake on LDL particle size.

Mauger et al. investigated this question in a randomized, double-blind, clinical trial examining the effects of dietary *trans*-fat vs. saturated fat on LDL particle size in 36 men and women with mild hypercholesterolemia (defined as LDL cholesterol concentration >3.36 mmol/L). None of the participants were taking lipid-lowering medications. All were free from other CVD risk factors such as diabetes, impaired hepatic, renal, and cardiac function, and the use of tobacco. The participant group was comprised of 18 men and 18 women, all between the ages of 57 and 73.

Participants underwent five diet treatments (each lasting 35 days) in random order. After the 28th day of each treatment, three fasting blood samples were taken and analyzed for lipid and apolipoprotein levels and for classification of LDL particle size. All five diets were identical with regard to macronutrient distribution (55% carbohydrate, 15% protein, 30% fat), with the source of 2/3 of the fat being the only variation between diets. Primary fat sources were butter and soybean oils representing varying degrees of saturation. Fat sources were as follows: 1) butter (primarily saturated fat); 2) semiliquid margarine (lowest in trans fatty acids; contained some cottonseed oil); 3) soft margarine; 4) shortening; and 5) stick margarine (highest in *trans*-fatty acids). Meals for the five diets were provided to participants, who were expected to consume all foods provided and to refrain from eating any supplemental foods or beverages (except water and calorie-free beverages).

Plasma lipid profiles measured following each diet treatment demonstrated that although total and LDL cholesterol levels increased with the degree of vegetable oil hydrogenation, the highest levels were observed after the butter-enriched diet. With regard to peak LDL particle size, the largest particles were observed following the butter-enriched regimen, while the smallest were detected following the stick-margarine enriched diet (highest in *trans*-fatty acids). LDL

Continued from page 5

integrated diameter—a measure that includes all LDL particle subclasses for a given participant—was again smaller following the stick-margarine regimen than after the butter-enriched diet. There was no dose-response relationship with regard to the relative distribution of small, medium, and large LDL particles. However, overall, large and medium sized LDL particle concentrations were higher following consumption of the butter-enriched regimen than following any of the hydrogenated oil enriched diets. Although small, there was an increase in plasma triacylglycerol concentrations parallel to consumption of diets with increasing levels of hydrogenation. Consumption of *trans*-fatty acids appeared to have no effect on CETP (cholesterol ester transfer protein) or PLTP (phospholipid transfer protein) activity, indicating that the reverse cholesterol transport rate remained unchanged with *trans*-fat intake.

LDL particles appear to decrease in size with increased consumption of *trans*-fatty acids. The authors conclude that if a diet high in hydrogenated oils is maintained, the continued rise in small LDL particles over time could significantly increase an individual's risk of CVD (by ~11% in the 5-year risk of ischemic heart disease according to data from the Quebec Cardiovascular Study). Although the observed change in particle size within this study group was small, the clinical implications for free-living populations are potentially significant. The results of this study support public health messages that encourage reduction of dietary intake of saturated and *trans*-fatty acids to decrease the risk of CVD.

Mauger J, Lichtenstein AH, Ausman L, et al. Effect of different forms of dietary hydrogenated fats on LDL particle size. *Am J Clin Nutr. 2003*;78:370-5.

Use of a Low-Glycemic Load Diet in the Treament of Adolescent Obesity

Glycemic index (GI)—defined as the extent to which a given food raises blood sugar in comparison to a standard carbohydrate (sucrose or white bread)—has been associated with obesity and the development of type 2 diabetes. Research using GI, however, has had limited application because GI is impractical for use in clinical trials where diet patterns are taken into consideration. Glycemic load (GL), calculated by multiplying glycemic index by the grams of carbohydrate present in a food, places GI in a practical framework, facilitating its usefulness in the context of whole foods, meals, and dietary patterns. Consumption of higher-GL foods is associated with increased hunger and ad lib food consumption compared to consumption of lower-GL foods. Lower-GL foods are thought to induce more satiety, and thus reduce overall calorie intake. The implications of using reduced-GL diet patterns for weight loss are potentially important, especially as they relate to obesity and the risk for type 2 diabetes in young populations.

Researchers at Children's Hospital Boston undertook a weight-loss intervention study to examine the effectiveness and feasibility of a long-term reduced-GL diet in adolescents. Sixteen obese adolescents (5 male, and 11 female), ages 13-21, were randomized to the control (reduced-fat, conventional diet) or intervention diet (reduced-GL diet). During a 6-month intervention phase, participants received intense dietary and behavioral counseling relative to their prescribed diet. Participants were followed for an additional 6 months to assess long-term effectiveness and adherence.

The eight participants randomized to the control group were given a reduced-fat (conventional weight loss) diet prescription, with 55%-60% of total calories from carbohydrate, 25%-30% from fat, and the rest from protein. They were counseled to decrease fat intake and to emphasize intake of fruits, vegetables, and grains. Participants in the control group were provided with meal plans designed to provide a calorie deficit of 250-500 kcals/day.

The eight participants randomized to the reduced-GL intervention group were instructed to balance protein, fat, and carbohydrate intake at every meal and snack and to emphasize non-starchy, moderate- to low-GL sources of carbohydrate. Participants were not counseled to restrict food intake, but were encouraged to eat to satiety and snack when hungry. It was expected that this meal pattern would result in 45%-50% of total calories coming from carbohydrate, 30%-35% from fat, and the remainder from protein.

Each adolescent received 12 dietary counseling sessions over the first 6-month intensive intervention period followed by 2 additional sessions during the 6 months of follow-up. All participants received the same counseling regarding physical activity. Dietary counseling sessions included in-depth nutrition education and behavior therapy based on social cognitive theory. Seven-day food diaries were used to assess dietary intake at baseline, month 3, month 6, and month 12. Adherence to the dietary regimen was also assessed by self-reported intake. Total body mass and fat mass was measured by dual-energy x-ray absorptiometry (DEXA) at baseline, month 6, and month 12. Height, blood glucose concentration, serum insulin level, and estimated insulin resistance were obtained at the same intervals. At baseline, there were no differences between groups

Continued from page 6

regarding age, body mass, height, BMI, or estimated insulin resistance. However, fat mass was lower in the reduced-GL group.

At the conclusion of the study, both BMI (P=0.03) and fat mass (P=0.02) had decreased significantly from study initiation for the reduced-GL group. There was no significant change in either BMI or fat mass for controls. GL did decrease significantly in the reduced-GL participants (intervention period, P=0.005; follow-up period, P=0.007), but not in controls. Fat intake decreased significantly for the control group (intervention period, P=0.01; follow-up period, P=0.03), while it appeared to increase for the low-GL group during the intervention phase (P=0.06). Carbohydrate intake also decreased in the low-GL group during the intervention phase (P=0.03).

Comparing the two groups, the decline in BMI (-1.3 ± 0.7 vs 0.7 ± 0.5; P=0.02) and fat mass (-3.0 ± 1.6 vs 1.8 ± 1.0 kg; P=0.01) was significantly greater in the low-GL group. Bivariate linear regression analysis demonstrated that GL was not only a significant, but strong, predictor of changes in fat mass for both groups (R^2=0.51; P=0.006) during the intervention period (from 0 to 6 months). Change in dietary fat intake did not predict changes in fat mass. Also notable, after adjustment for change in BMI, estimated insulin resistance remained unchanged for participants in the reduced-GL group, while a significant increase was observed in controls. The authors note that insulin resistance typically increases with pubertal changes in adolescence. The reduced-GL diet might have provided some protection against this expected increase.

Weaknesses in study design include a small sample size, self-reporting of food consumption for assessment of nutrient intake and adherence to prescribed diets, and no standardized tracking of physical activity among participants. Changes in BMI were small for a study of this duration. However, it is impressive that the dietary counseling method used with the low-GL group did result in decreased BMI from baseline to 12 months and decreased fat mass from baseline to 6 months as well as from 6 to12 months. This indicates that the participants learned skills during the intensive counseling period (0-6 months) that they were able to use successfully during the more independent follow-up phase (6-12 months). This also indicates that the low-GL diet is a feasible long-term diet for weight management. Diet adherence may have been related to increased satiety due to decreased consumption of high-GL foods.

The absence of short- and long-term changes in BMI and fat mass in the control group suggests that calorie- and fat-restricted diets might not be as effective in adolescent populations. The non-restrictive, ad lib nature of the low-GL diet pattern (which might appeal to the independence craved by most adolescents) is also likely to have contributed to overall physical and psychological satisfaction. The data presented here by Ebbeling et al. provide justification for further research using reduced-GL diets in overweight populations. These results also suggest that GL data might be useful in the development of meal plans that induce satiety and increase long-term adherence to dietary programs for weight-loss and fitness.

Ebbeling CB, Leidig MM, Sinclair KB, et al. A reduced-glycemic load diet in the treatment of adolescent obesity. *Arch Pediatr Adolesc Med*. 2003;157:773-779.

Editorial: *Foods, Fads, and Phobias*

Thirty years ago science knew it had the answer to the scourge of heart disease and cancer—a low-fat diet. Congress held hearings, policies were established, the food industry was dragged on board, and all that was left was to get the public to live the low-fat life. Industry was asked to produce a thousand low-fat foods and government agencies and health promotion groups unified their messages from the Nutrition Facts Label to the Dietary Guidelines to the Food Guide Pyramid. Consumers were taught progressively more complex messages—from low-cholesterol to low-fat to low-saturated fat to low saturated and *trans*-fat. But, since one must live with unintended consequences, consumers went from being relatively active to inactive, shifted from high-fat to high-sugar diets, and went from dining at home to dining (or at least carrying) out—all of this leading to today's obesity epidemic. And in the background, waiting for the right moment, were the heretics who championed the low-carbohydrate diet.

It's funny, if you've been around long enough, to remember beer ads touting "cholesterol-free" beverages. Today the same ads are praising "low-carb" beer. [What exactly is a "light, cholesterol-free, non-alcoholic, low-carb beer" anyway? And why would anyone want to drink it?] It's also curious to watch the onslaught of low-carb products being advertised after so many years of fat-free, cholesterol-free, low-calorie marketing. What makes it all the more unique is that this is occurring without sanction from government agencies and health promotion groups, but rather by consumers who, after hearing years of bickering from the "scientists" and "food police" and recurrent trips to the department store to buy the next size of clothing, finally said, "a pox on all your houses," and started talking to each other about what did and didn't work for weight loss. What a novel idea! Nutrition

Editorial cont...

Continued from page 7

education from the bottom up rather than from the top down. A case of anecdotal success stories superceding what were unproven directives from on high.

So the public wants low-carb, the medical community wants low-fat, the food police simply want to do away with whatever tastes good. A few thoughtful, open minded scientists have finally started researching the question. The terminology alone is enough to drive anyone to extremes: good and bad cholesterol (in the blood), good and bad fats (in the diet), and now good and bad carbs (virtually everywhere). And the public is talking about glucose and insulin and glucagon and glycemic index, all in the name of weight loss. How frustrating it must be for the "diet-lipid-heart disease" mafia, which has held sway for the past thirty years, to see the public doubt the truth of their gospel. Maybe this is a case of too many negative messages and not enough positive direction.

Is the low-carb, high-protein diet a phase or will it be around for a while? That's hard to say given the historical vacillations of the public when it comes to diet fads. And then one needs to ask whether this is a backlash against years of government pronouncements and the ranting and raving of various "food police" talking heads telling the public what they should (and mostly should not) eat. On the other hand, if it works, as many people seem more than willing to attest to, then its long-term prognosis would seem pretty good, especially if more research studies present data substantiating the claims. Kind of reminds me of the Woody Allen movie "Sleeper" where diet advice gets turned on its head and the good becomes bad and the bad, good.

One of the most interesting aspects of the conflict is that the assumed negative impact of the low-carb diet on plasma lipid profiles isn't being observed in the studies. Maybe it's because the dietary effects are just too small to measure, especially during periods of weight loss. The question is what happens when the new stable weight is achieved. At least now that the research is actually being done we might get an answer. Too bad it took twenty years of nay saying and ridicule before those who knew all the answers finally got overruled, allowing actual studies to be carried out. Makes one wonder whether it was a sense of absolute certainty on their part or maybe a deep-seated sense that they didn't have all the truth on their side. The Diet of the Low-Carb has posted its edict on the door of the Holy Low-Fat Church and the reformation of dietary indulgences has clearly opened a new era of debate. Heaven help us all.

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