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Dietary Intakes Associated with Successful Weight Loss and Maintenance during the Weight Loss Maintenance Trial

CATHERINE M. CHAMPAGNE, PhD, RD, LDN, FADA; STEPHANIE T. BROYLES, PhD; LAURA D. MORAN, MS, RD, LD; KATHERINE C. CASH, RD, LDN; ERMA J. LEVY, MPH, RD; PAO-HWA LIN, PhD; BRYAN C. BATCH, MD; LILLIAN F. LIEN, MD; KRISTINE L. FUNK, MS, RD; ARLENE DALCIN, RD, LDN; CATHERINE LORIA, PhD, MS, MA; VALERIE H. MYERS, PhD

ABSTRACT

Background Dietary components effective in weight maintenance efforts have not been adequately identified.

Objective To determine the effects of changes in dietary consumption on weight loss and maintenance during the Weight Loss Maintenance clinical trial.

Design Weight Loss Maintenance was a randomized controlled trial. Successful weight loss participants who completed Phase I of the trial and lost 4 kg were randomized to one of three maintenance intervention arms in Phase II and followed for an additional 30 months.

Participants/setting The multicenter trial was conducted from 2003 through 2007. This substudy included 828 successful weight loss participants.

Methods The Block Food Frequency Questionnaire (FFQ) was used to assess nutrient intake levels and food group servings. Carbohydrates, proteins, fats, dietary fiber, fruit/vegetable, and dairy servings were utilized as predictor variables. The FFQ was collected on all participants at study entry (beginning of Phase I). Those randomized to Phase II completed the FFQ at three additional time points: randomization (beginning of Phase II), 12 months, and 30 months.

Intervention The main intervention focused on long-term maintenance of weight loss using the Dietary Approaches to Hypertension diet. This substudy examined if changes to specific dietary variables were associated with weight loss and maintenance.

Statistical analyses performed Linear regression models that adjusted for change in total energy examined the relationship between changes in dietary intake and weight for each time period. Site, age, race, sex, and a race–sex interaction were included as covariates.

Results Participants who substituted protein for fat lost, on average, 0.33 kg per 6 months during Phase I ($P<0.0001$) and 0.07 kg per 6 months during Phase II ($P<0.0001$) per 1% increase in protein. Increased intake of fruits and vegetables was associated with weight loss in Phases I and II: 0.29 kg per 6 months ($P<0.0001$) and 0.04 kg per 6 months ($P=0.0062$), respectively, per 1-serving increase. Substitution of carbohydrates for fat and protein for carbohydrates were associated with weight loss during both phases. Increasing dairy intake was associated with significant weight loss during Phase II (−0.17 kg per 6 months per 1-serving increase,

C. M. Champagne is a professor, S. T. Broyles is an assistant professor, K. C. Cash is a research dietitian/interventionist, E. J. Levy is a research dietitian/interventionist, and V. H. Myers is an instructor, Pennington Biomedical Research Center, Baton Rouge, LA. L. D. Moran is a clinical dietitian, Baton Rouge Clinic, Baton Rouge, LA. P.-H. Lin is an associate research professor, Department of Medicine, Nephrology Division, B. C. Batch is with the Department of Medicine, Endocrinology, Metabolism, and Nutrition Division, and L. F. Lien is medical director, Duke Inpatient Diabetes Management, and an assistant professor, Department of Medicine, Endocrinology, Metabolism, and Nutrition Division, Sarah W. Stedman Nutrition and Metabolism Center, Duke University Medical Center, Durham, NC. K. L. Funk is a research associate III, Kaiser Permanente Center for Health Research, Portland, OR. A. Dalcin is a research associate, Johns Hopkins ProHealth, Baltimore, MD. C. Loria is a nutritional epidemiologist, Division of Cardiovascular Services, National Heart, Lung, and Blood Institute, Bethesda, MD.

Address correspondence to: Catherine M. Champagne, PhD, RD, LDN, FADA, Pennington Biomedical Research Center, 6400 Perkins Rd, Baton Rouge, LA 70808-4124. E-mail: catherine.champagne@pbrc.edu

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$P=0.0002$), but not during Phase I. Dietary fiber revealed no significant findings.
Conclusions Increasing fruits, vegetables, and low-fat dairy may help achieve weight loss and maintenance.
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Obesity is a major contributor to soaring health-care costs. The rising prevalence of obesity was reported to be responsible for almost $40 billion of increased medical spending in 2006, whereas the overall medical costs of obesity accounted for an estimated $147 billion per year in 2008 (1). Using prevalence data from the National Health and Nutrition Examination Survey, Wang and colleagues (2) predict that, should current trends continue, within 15 years 80% of all adults in the United States will be either overweight or obese.

Many weight loss interventions are aimed at changing behaviors and lifestyles. These interventions include prolonged continuous intervention contacts (3-5), self-monitoring (6,7), accountability (8,9), motivational interviewing (10-13), frequent self-weighing (14), and regular physical activity (15-17). The American Dietetic Association (ADA) has noted that achieving a negative energy balance is the most important factor affecting amount and rate of weight loss over time (18). Recommended strategies to achieve negative energy balance include kilocalorie counting, modifying macronutrient composition and/or energy density, and may include meal replacements or low-energy diets. Reducing dietary fat and/or carbohydrates is a practical way to create an energy deficit of 500 to 1,000 kcal per day, and should result in a weight loss of 1 to 2 lb/week (18). Hill (19) notes that even small reductions in energy intake (~100 kcal), coupled with increased physical activity, can help reduce weight gain and may have a greater likelihood of being sustained in the long term.

The US Department of Agriculture's (USDA) MyPyramid helps people interpret the USDA's Dietary Guidelines for Americans, and essentially promotes a diet high in fruits and vegetables and low in fat (20). The guidelines are jointly issued and updated every 5 years by the USDA and the US Department of Health and Human Services. The general message of MyPyramid is that good dietary habits can promote health and reduce risk for major chronic disease; the guidelines recommend the Dietary Approaches to Stop Hypertension (DASH) diet as a model of healthy eating (20). The DASH diet promotes fruit and vegetable intake, intake of low-fat dairy, focus on whole grains, reduced intake of meat, and is low in fat at approximately 27% to 28% of total energy (21). The DASH diet was shown to be effective for weight loss in the PREMIER Study, which preceded the Weight Loss Maintenance (WLM) trial and was conducted by the same investigative team, and included both African Americans and white Americans who were overweight and had hypertension (22).

Despite the recommendations by USDA and the proven outcomes associated with the DASH diet, the research examining diet composition for the management of obesity remains mixed. Previous studies have found that low-fat diets promote short-term weight loss (23); however, some studies suggest that low-carbohydrate, high-protein, and high-fat diets may also result in substantial weight loss (24). However, evidence for type of diet on long-term weight maintenance remains debatable (25,26). A substantial body of literature exists suggesting that weight loss can be achieved by varying the macronutrient distribution and composition of dietary factors. Specifically, in a systematic review by Abete and colleagues (27), it was concluded that there are numerous dietary strategies focused on macronutrient distribution many of which have good weight loss outcomes. However, the challenge remains to find the appropriate approach for weight maintenance and relapse prevention tailored to the individual.

Therefore, the purpose of this substudy was threefold: to provide additional evidence to the literature on macronutrient composition specific to a diverse population of at-risk patients with cardiovascular disease; to determine which changes in consumption of macronutrients, fruits, vegetables, low-fat dairy and dietary fiber were associated with weight loss during an intensive behavioral weight loss phase (ie, Phase I of the WLM trial); and to determine which changes in macronutrients, fruit, vegetable, low-fat dairy, and dietary fiber consumption were associated with maintenance of weight loss across a 30-month period (ie, WLM trial Phase II).

STUDY METHODS

The WLM study was funded by the National Heart, Lung, and Blood Institute (NHLBI) and included 1,032 participants from four different sites (Pennington Biomedical Research Center, Baton Rouge, LA; Kaiser Permanente Center for Health Research, Portland, OR; Johns Hopkins University, Baltimore, MD; and Duke University Medical Center, Durham, NC). The study was approved by institutional review boards at each participating site and by a protocol review committee appointed by the NHLBI. All participants provided written informed consent, and a data and safety monitoring board provided trial oversight. Enrollment occurred from August 2003 to July 2004 and randomization took place February through December 2004. Data collection was completed in June 2007.

The purpose of the WLM study was to examine strategies for maintenance of weight loss after an initial 6-month weight loss phase (Phase I) and during a 30-month weight loss maintenance phase (Phase II). During Phase I of WLM, participants were instructed in the basics of the DASH diet. They were specifically asked to increase consumption of fruits and vegetables, low-fat dairy and whole grains, along with other typical strategies for weight loss. Participants were encouraged to continue these dietary habits in Phase II.

Data used in this substudy were collected at four time points: entry into the trial (before Phase I), baseline (before randomized into Phase II), 12 months post-randomization, and 30 months post-randomization. Data collection included calibrated height and weight and dietary intake information in the form of the Food Frequency Questionnaire (FFQ) (28). A total of 1,685 participants completed Phase I of the trial. The 1,032 participants who lost a minimum of 4 kg (ie, successful Phase I participants) were randomized to the weight maintenance phase