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Randomization to plant-based dietary approaches leads to larger short-term improvements in Dietary Inflammatory Index scores and macronutrient intake compared with diets that contain meat☆

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ABSTRACT

Studies have examined nutrient differences among people following different plant-based diets. However, all of these studies have been observational. The aim of the present study was to examine differences in nutrient intake and Dietary Inflammatory Index (DII) scores among overweight and obese (body mass index 25.0-49.9 kg/m^2) adults randomized to receive dietary instruction on a vegan (n = 12), vegetarian (n = 13), pescovegetarian (n = 13), semivegetarian (n = 13), or omnivorous (n = 12) diet during a 6-month randomized controlled trial. Nutrient intake, nutrient adequacy, and DII score were assessed via two 24-hour dietary recalls (Automated Self-Administered 24-Hour Dietary Recall) at baseline and at 2 and 6 months. Differences in nutrient intake and the DII were examined using general linear models with follow-up tests at each time point. We hypothesized that individuals randomized to the vegan diet would have lower DII scores and greater improvements in fiber, carbohydrate, fat, saturated fat, and cholesterol at both 2 and 6 months as compared with the other 4 diets. Participants randomized to the vegan diet had significantly greater changes in most macronutrients at both time points, including fat and saturated fat, as well as cholesterol and, at 2 months, fiber, as compared with most of the other diet groups (Ps < .05). Vegan, vegetarian, and pescovegetarian participants all saw significant improvements in the DII score as compared with semivegetarian participants at 2 months (Ps < .05) with no differences at 6 months. Given the greater impact on macronutrients and the DII during the short term, finding ways to provide support for adoption and maintenance of plant-based dietary approaches, such as vegan and vegetarian diets, should be given consideration.

Abbreviations: BMI, body mass index; CI, confidence interval; CRP, C-reactive protein; DII, Dietary Inflammatory Index; DRI, Dietary Reference Intake; Omni, omnivorous; OR, odds ratio; Pesco-veg, pescovegetarian; Semi-veg, semivegetarian; Veg, vegetarian.

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1. Introduction

Appropriately planned vegan and vegetarian diets are considered to be nutritionally adequate and may help prevent and treat certain chronic diseases [1]. The nutritional profile of plant-based diets, such as vegan (exclude all animal products), vegetarian (excludes all meat and seafood), pescovegetarian (excludes meat except seafood), and semivegetarian (limits meat) diets, can vary considerably from one another.

Several observational studies have examined differences in dietary intake and health-related outcomes by these varying dietary patterns, finding that participants choosing to follow a vegan diet have better diet quality; higher intakes of fiber; and lower intakes of total fat, saturated fat, protein, and calcium as compared with omnivores, with vegetarians, pescovegetarians, and semivegetarians falling in the middle between these 2 ends [2–4]. Vegetarians and vegans have significantly better metabolic risk factors [5], lower body mass indices [6], and lower prevalence of type 2 diabetes [6] as compared with semivegetarians or omnivores. Tied to many of these chronic diseases is the relationship between dietary intake and inflammation, a risk marker of cancer [7,8] and cardiovascular endpoints [9–11]. For example, studies have found that C-reactive protein (CRP) is lower in vegetarians compared with nonvegetarians [12–14] and that populations that eat very low fat, animal-sparse diets, such as in Japan, have very low CRP values [15,16]. These studies, however, are observational in design and examine the self-selected diets of study participants; and to date, there have been no randomized controlled trials examining the effects of recommending adoption of these varying plant-based diets on dietary intake and inflammatory potential.

The goal of this study was to examine the differences in nutrient intake and inflammatory potential of diets among participants randomized to conditions instructing them on how to follow a vegan, vegetarian, pescovegetarian, semivegetarian, or omnivorous control diet. We hypothesized that there would be greater increases in fiber and carbohydrate intake and greater decreases in total fat, saturated fat, protein, and cholesterol intake among participants randomized to a vegan diet as compared with the other 4 diets. Furthermore, we hypothesized that participants randomized to the vegan diet would have lower Dietary Inflammatory Index (DII) scores at both 2 and 6 months as compared with the other 4 diets. Briefly, the DII is a literature-derived, population-based dietary index that was developed to assess the inflammatory potential of an indivi
dual's diet and place it on a continuum from maximal proinflammatory diet to maximal anti-inflammatory diet [17,18]. Therefore, the objective of the present study was to examine differences in dietary intake and DII score at both 2 and 6 months among participants randomized to follow 1 of 5 different dietary approaches.

2. Methods and materials

The New Dietary Interventions to Enhance the Treatments for weight loss (New DIETs) study was a 2-month weight-loss intervention with a 4-month follow-up period conducted at a large university in the southeast. The methods have been described elsewhere [19,20]. Briefly, overweight and obese (body mass index [BMI] 25-49.9 kg/m^2) adults between the ages of 18 and 65 years were recruited for a 6-month weight loss intervention. Before randomization, participants were instructed on how to complete baseline questionnaires (all completed online), which included demographics and dietary intake from 2 days of unannounced 24-hour dietary recalls (1 weekday and 1 weekend day) collected using the Automated Self-Administered 24-Hour Dietary Recall [21]. Analyses included only intake from foods and did not include supplements (eg, multivitamins or mineral supplements). Nutrition adequacy was assessed by the percentage of participants within each group that met US Dietary Reference Intakes (DRI) or Dietary Guidelines for sodium [22] at each time point. The reference group for comparison with DRI consisted of women 48 years old, reflecting the average age and sex of participants in the study. The DRI do not specify a level of saturated fat or cholesterol but state that intake should be "as low as possible while consuming a nutritionally adequate diet" [23]. For saturated fat and cholesterol, a level of less than or equal to 7% of energy from saturated fat and a level of less than or equal to 300 mg/d of cholesterol was used based on American Heart Association recommendations [24]. All measures were assessed at baseline, 2 months, and 6 months. A university institutional review board approved the study, and all participants provided written informed consent. Participants received a $20 incentive payment for completion of all 2-month assessment activities but did not receive any incentives for completion of baseline or 6-month assessments.

2.1. *Dietary Inflammatory Index*

Various micro- and macronutrients, as well as several individual food items (known as *food parameters*), were used to calculate the DII. These food parameters used in the present study included energy; carbohydrates; protein; total fat; unsaturated, monounsaturated, and polyunsaturated fat; omega 3 and omega 6 fatty acids; grams of alcohol consumption; fiber; cholesterol; vitamins B-1, B-2, B-6, B-12, A, C, D, and E; iron; magnesium; zinc; selenium; folate; β-carotene; and caffeine. The development and validation of the DII have previously been described [17,18]. In short, the food parameters were assigned scores based on research summarizing findings from 1943 articles describing the relationship between the food parameters and inflammation. The DII calculation is linked to a regionally representative world database (ie, food consumption from 11 populations around the world) that provided a mean and standard deviation for each food parameter. The "standard mean" was subtracted from the actual food parameter value and divided by its standard deviation. This z score was then converted to a percentile (to minimize the effect of outliers or right skewing) and centered by doubling the value and subtracting 1. The centered percentile score for each food parameter for each individual was then multiplied by the respective food parameter effect score, which is derived from the literature review, to obtain a food parameter–specific DII score for an individual. All of the food parameter–specific DII scores are then summed to create the overall DII score for every