Low-Fat Diet: Effect on Anthropometrics, Blood Pressure, Glucose, and Insulin in Older Women

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Objective: The Women's Health Trial: Feasibility Study in Minority Populations (WHT: FSMP) documented that a low-fat diet was associated with a reduced fat intake in older women of diverse ethnic backgrounds. The purpose of the current study was to examine the effect of the low-fat diet on anthropometric and biochemical variables.

Design: Randomized clinical trial in 2,208 postmenopausal women, 50 to 79 years of age.

Results: The decrease in fat intake correlated directly with a decrease in body weight ($r=.22$, $P<.001$). After 6 months, the intervention group had an average weight loss of 1.8 kg. Body mass index decreased 0.7 kg/m^2. Waist circumference decreased 1.8 cm. All of these changes were statistically significant, compared to changes in the control group ($P<.01$). Changes in systolic (−3.1 mm Hg) and diastolic (−1.1 mm Hg) blood pressures (BP) occurred in the intervention group. The decrease in systolic BP reached statistical significance ($P=.02$), relative to the control group. Decreases in plasma glucose were small (−0.2 mmol/L) in the intervention group, although there was a trend for difference from the control group ($P=.11$). Decreases in serum insulin levels were small (−0.5 μIU/mL) in the intervention group, although there was, again, a trend for difference from the control group ($P=.07$).

Conclusions: In older White, Black, and Hispanic women, a long-term low-fat dietary intervention was accompanied by modest, but statistically significant, decreases in body weight and anthropometric indices, without any particular attempt being made to reduce calories. Changes in glucose and insulin were small. The long-term biological significance of the glucose and insulin changes is unknown. (*Ethn Dis.* 2003;13:337–343)

Key Words: African American, Blood Pressure, Clinical Trial, Dietary Fat, Glucose, Hispanic, Insulin, Women's Health

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Introduction

A high-fat intake is associated with obesity and its associated risks of hypertension, diabetes mellitus, coronary artery disease, and breast cancer.[1–9] This is of special concern due to the increasing prevalence of overweight in US women,[10] especially among minorities.[11] Few data are available on the effects of a low-fat diet on body weight, waist circumference, blood pressure (BP), glucose, or insulin, in a large sample of older women, especially from minority populations.

The Women's Health Trial: Feasibility Study in Minority Populations (WHT:FSMP) was a randomized controlled clinical trial designed to test the feasibility of a low-fat dietary intervention in postmenopausal women of diverse ethnic and socioeconomic backgrounds.[12] The WHT:FSMP has demonstrated that the recruitment and dietary intervention were feasible, thereby providing the rationale for the current Women's Health Initiative (WHI). The 6-month decrease in fat intake was from 39.7% of total energy to 26.4% (a reduction of 13.3% of energy), compared to a reduction from 39.7% to 37.4% (a 2.3% reduction) in the control group ($P<.05$).[13] The primary purpose of the current report is to provide data on the 6-month effect of the low-fat diet on body weight, body mass index (BMI), waist and hip circumference, BP, glucose, and insulin, in the 2,208 study participants.

Methods

Organization and Design

The WHT:FSMP was a collaborative effort among the National Cancer Institute; the National Heart, Lung, and Blood Institute; 3 clinical centers (Emory University in Atlanta, the University of Alabama at Birmingham, and the University of Miami); and the Fred Hutchinson Cancer Research Center in Seattle, which acted as Statistical and Nutrition Coordinating Center (SNCC). Recruitment and randomization began in August 1992. Intervention and follow up continued through August 1994.

Details of the instruments and methods for data collection and overall dietary intake changes have been published.[12,13] In summary, postmenopausal women of diverse ethnic backgrounds were randomized to either a low-fat dietary intervention or a control group, with a minimum follow up of 6 months, and a maximum follow up of 18 months. The intervention group significantly reduced their reported intakes of total fat, saturated fat, and cholesterol, and increased their intake of fruits and vegetables, relative to the control group. Staff who collected the clinical

Special minority-focused recruitment efforts were successful. Of the 2,208 randomized participants, 1,229 (56%) were non-Hispanic White, 624 (28%) were Black, and 355 (16%) were Hispanic.

data were blinded to the intervention arm. The trial was approved by the institutional review board of each institution, and participants provided written informed consent following full explanation of the study procedures.

Study Population

More than 19,000 postmenopausal women contacted the clinical centers and completed screening forms; 2,208 were enrolled.[14] To be eligible, women had to be 50 to 79 years of age, postmenopausal, and consuming a diet with at least 36% of total energy deriving from fat, as estimated by a food frequency questionnaire (FFQ), with a reference period of the prior 3 months.[15] Women taking medications to alter blood lipids, or receiving insulin for diabetes, were excluded. Also excluded were women who were 165% or more of their ideal body weight, based on the 1983 Metropolitan Life Insurance Table of Weights for a medium frame.[16]

Special minority-focused recruitment efforts were successful. Of the 2,208 randomized participants, 1,229 (56%) were non-Hispanic White, 624 (28%) were Black, and 355 (16%) were Hispanic. Hispanic participants (99%) were mainly in the Miami center, whereas Black participants were mainly in the Atlanta (66% of Black participants) and Birmingham centers.

Dietary Intervention

Sixty percent of participants (N=1,325) were randomized to the dietary intervention with a primary goal of reducing total fat intake to 20% or less of total energy. Additional goals included reducing intakes of saturated fatty acids and cholesterol, and increasing servings of fruits, vegetables, and whole grain products. There was no intent to modify or monitor dietary sodium or potassium intake, although the latter could increase as a result of increased servings of fruits and vegetables. Control participants (N=883) received only a pamphlet on general dietary guidelines,[17] a broad intervention (with no counseling) unlikely to alter their chronic dietary intakes. Details of the special dietary intervention are described elsewhere.[13] In summary, women randomized to the dietary intervention were assigned to a group of 8 to 15 members led by a research nutritionist. The groups met weekly for 6 weeks, biweekly for 6 weeks, monthly for 9 months, then quarterly. Each woman was given a personal daily fat gram goal (average 32 g) based on height and kilocalories (kcal) consumed, as estimated from the screening FFQ. Changes in dietary intake were estimated from repeated administration of the FFQ. Overall, dietary intervention session participation rates averaged from 70% to 95%, depending on demographic subgroup.

The main purpose of WHT:FSMP was to document the feasibility of the recruitment and intervention methods. Women were randomized over an 18-month period; the duration of follow up varied because the study stop date was the same for all participants, regardless of their entry date. Many women were recruited relatively late in the study, with administrative censoring prior to their scheduled 12- or 18-month visit. However, a large number of women (1,720) completed the 6-month visit and FFQ. This represents 1,071 of the 1,325 women randomized to the intervention group (80.8%), and 649 of the 883 women randomized to the control group (73.5%). The change in the total number of participants at the baseline and 6-month interval primarily reflects the follow-up time available following randomization, rather than study dropout.

MEASURES

General

Self-administered FFQs, anthropometric and blood pressure measurements, and blood specimens, were collected at baseline, and again at 6 months post-randomization. For cost-effectiveness, 40% of the 6-month blood specimens were selected for analysis, unless the 6-month visit was the final visit, in which case the specimen was analyzed. Blood was stored at the clinical center at −20°C or lower, and shipped to SNCC at least once monthly, where cryovials were stored at −70°C until analysis. Blood collections followed a specific protocol, with a minimal fasting time of 12 hours. If the participant was not fasting, the blood collection was rescheduled. Changes in plasma cholesterol levels are only mentioned briefly here, because these data were assigned for review and future publication by a separate WHT:FSMP writing committee.

Anthropometrics

Trained and certified clinic staff measured body weight to the nearest half-pound, using a calibrated balance beam scale. Height was measured (at baseline) to the nearest half-inch, using a stadiometer. Both weight and height were obtained with study participants lightly clothed, and without shoes. Trained and certified staff made waist measurements (at the end of a normal expiration, with the patient in the standing position, and wearing minimal clothing) at the smallest circumference between the ribs and iliac crest. Hip measurements were obtained at the larg-

est circumference at the posterior extension of the buttocks.

Blood Pressure

Participants' blood pressure (BP) (right arm) was measured by trained clinic staff, after 5 minutes of rest in the seated position, using a conventional sphygmomanometer. The average of 2 measurements was used as the value for the visit. Diastolic pressure was measured as the point of disappearance (phase V) of Korotkoff sounds. Large cuffs (adult obese) were used as appropriate for women with large arms.

Plasma Glucose and Serum Insulin

Glucose was measured by autoanalyzer, using K_3EDTA anticoagulant and a standardized hexokinase method. Insulin was measured by radioimmunoassay, using antibody coated polypropylene tubes in a modified (Coat-A-Count, Diagnostic Products Corp, Los Angeles, California) radioimmunoassay.[18] The antibody had negligible cross reactivity with c-peptide or glucagon. The inter-assay coefficients of variation at insulin concentrations of 8 μIU/mL, 37 μIU/mL, and 96 μIU/mL, were 18.8%, 10.8%, and 10.4%, respectively.

DATA ANALYSIS

For variables of interest, the differences by ethnic group between the baseline and 6-month follow-up measurements were computed for each participant, and means were calculated for the intervention and control groups. Differences were symmetrically distributed about their means, although some cross-sectional measures had distributions departing from normality.

The difference between changes in the intervention and control groups was considered to be the "intervention effect." Adjusted differences were obtained using an analysis of variance model containing terms for treatment and adjusted for clinic, and the clinic × treatment interaction.[19,20] This interaction term was dropped when it was not significant at $P \leq .05$. Only unadjusted intervention effects are reported, because they were almost identical to the adjusted effects.

RESULTS

Six-Month Changes in Fat Intake, Body Weight, and Anthropometric Indices

Table 1 exhibits the baseline characteristics of randomized participants. Although there were differences among ethnic groups, there were no differences between intervention and control groups.

Table 2 shows changes in reported fat intake (from the FFQ), body weight, BMI, and waist/hip circumferences in the control and intervention groups, and by ethnicity. In the overall intervention group (all ethnic groups), total reported fat intake decreased from 39.7% to 26.4% of total energy, an absolute reduction of 13.3%. (As an example, this reduction represents a decrease in reported absolute fat intake from 82.4 g/day to 38.9 g/day). Total reported energy intake decreased by 538 kcal/d (from 1,834 kcal/day to 1,296 kcal/day). The average weight loss was 1.8 kg (from 75.1 kg to 73.3 kg). The range of 6-month changes was similar among White (−2.0 kg), Black (−1.5 kg), and Hispanic (−1.4 kg) women. The average change in BMI was 0.7 kg/m^2 (from 28.7 kg/m^2 to 28.0 kg/m^2). Body weight and BMI decreased significantly more in the intervention vs the control group ($P < .001$).

A baseline waist circumference >88 cm was present in 39%, 51%, and 36%, of White, Black, and Hispanic women, respectively. In the intervention group, weight loss was accompanied by a significant mean decrease in both waist (1.8 cm, $P < .01$; from 86.1 cm to 84.3 cm) and hip (1.8 cm, $P < .001$; from 107.9 cm to 106.1 cm) circumferences, without any change in the waist-to-hip ratio (WHR). The average waist and hip circumferences decreased minimally (−0.1 and 0.4 cm, respectively) in the control group. Net differences between the intervention and control groups (I-C) were −1.7 cm for waist circumference ($P < .05$), and −1.4 cm for hip circumference ($P < .05$).

Changes in Blood Pressure (Table 3)

The average BP decreased in the intervention group (from 127.1/76.3 mm Hg to 124.0/75.2 mm Hg). The net difference between the intervention and control groups (I-C) was −1.7 mm Hg for systolic blood pressure (SBP), and −0.4 mm Hg for diastolic blood pressure (DBP). The decrease in SBP at 6 months in the intervention group reached statistical significance ($P = .02$), relative to the control group.

Changes in Glucose and Insulin Levels

Changes in fasting plasma glucose and serum insulin levels are shown in Table 3. In the overall intervention group (all ethnicities), the decrease in glucose was small (−0.2 mmol/L; from 5.3 mmol/L to 5.1 mmol/L, or 95.5 mg/dL to 91.9 mg/dL), with a trend for net differences between the intervention and control groups (−0.1 mmol/L, $P = .11$).

Serum insulin levels decreased slightly (−0.5 μIU/mL, from 11.1 μIU/mL to 10.6 μIU/mL) in the overall intervention group, with a trend for net differences between the intervention and control groups (−0.7 μIU/mL, $P = .07$). The net directional changes were fairly consistent among the three ethnic groups. A secondary analysis of glucose and insulin changes was also performed, excluding 66 randomized diabetic participants. The pattern of this analysis was similar to the main analysis.

Regression Analyses

Change in fat intake correlated directly with change in body weight

Table 1. Baseline characteristics of randomized participants

Variable	Ethnicity	*N**	Intervention Mean ± SD	Control Mean ± SD
Age	All	2208	60.1 ± 6.6	59.8 ± 6.6
	White	1205	60.5 ± 6.7	60.0 ± 6.7
	Black	623	59.4 ± 6.6	59.7 ± 6.8
	Hispanic	355	59.9 ± 6.2	59.1 ± 5.9
Fat (% energy)	All	2207	39.7 ± 7.1	39.1 ± 7.0
	White	1205	40.3 ± 6.9	39.3 ± 7.0
	Black	623	40.0 ± 7.1	39.0 ± 6.9
	Hispanic	354	37.4 ± 7.4	38.5 ± 7.4
Energy (kcal/d)	All	2207	1834 ± 927	1766 ± 836
	White	1205	1826 ± 754	1787 ± 750
	Black	623	1766 ± 1025	1662 ± 889
	Hispanic	354	1983 ± 1227	1864 ± 988
Systolic BP (mm Hg)	All	2208	127.1 ± 19.1	127.3 ± 18.3
	White	1205	125.1 ± 18.8	124.5 ± 17.7
	Black	623	129.0 ± 18.4	131.4 ± 19.3
	Hispanic	355	129.9 ± 20.5	128.9 ± 17.2
Diastolic BP (mm Hg)	All	2208	76.3 ± 9.7	76.9 ± 9.5
	White	1205	75.0 ± 9.6	75.5 ± 8.7
	Black	623	79.0 ± 9.8	79.6 ± 9.7
	Hispanic	355	75.8 ± 9.0	77.0 ± 10.2
Weight (kg)	All	2208	75.1 ± 12.5	75.8 ± 12.7
	White	1205	73.5 ± 12.4	74.6 ± 12.7
	Black	623	79.6 ± 12.1	80.6 ± 11.8
	Hispanic	355	72.8 ± 11.8	72.0 ± 11.8
BMI (kg/m^2)	All	2208	28.7 ± 4.6	29.1 ± 4.8
	White	1205	27.8 ± 4.6	28.1 ± 4.5
	Black	623	30.1 ± 4.3	30.5 ± 4.3
	Hispanic	355	29.2 ± 4.4	29.8 ± 5.5
Waist (cm)	All	2205	86.1 ± 10.8	86.4 ± 10.8
	White	1202	85.0 ± 11.4	85.6 ± 11.3
	Black	623	88.7 ± 9.9	88.6 ± 9.9
	Hispanic	355	85.1 ± 9.4	85.3 ± 10.5
Hips (cm)	All	2208	107.9 ± 9.5	108.4 ± 9.6
	White	1205	107.2 ± 9.6	107.9 ± 9.7
	Black	623	109.7 ± 9.0	110.3 ± 9.2
	Hispanic	355	107.0 ± 9.2	106.8 ± 9.3
Plasma glucose (mmol/L)	All	2206	5.3 ± 1.5	5.3 ± 1.6
	White	1203	5.1 ± 1.0	5.1 ± 0.8
	Black	623	5.5 ± 2.1	5.6 ± 2.2
	Hispanic	355	5.2 ± 1.2	5.3 ± 2.1
Serum insulin (ulU/mL)	All	2193	11.1 ± 6.8	11.2 ± 6.8
	White	1196	10.2 ± 5.7	10.4 ± 6.0
	Black	619	11.9 ± 7.3	12.1 ± 7.4
	Hispanic	355	12.8 ± 8.6	11.9 ± 6.9
Hormone replacement therapy (%)	All	2206	43.4%	43.3%
	White	1203	53.9%	54.2%
	Black	623	32.6%	30.5%
	Hispanic	355	26.6%	28.4%
Hypertension† (%)	All	2208	39.1%	38.8%
	White	1205	33.6%	31.7%
	Black	623	49.2%	53.1%
	Hispanic	355	38.7%	38.5%

* Some cells have missing data [maximum 33 White (1.5%), 5 Blacks (0.8%), and 2 Hispanics (0.6%)].
† SBP ≥140, DBP ≥90, or receiving antihypertensive medications.

(r=.22, P<.001). Multiple linear regression analysis was performed using changes in SBP and DBP as dependent variables, and baseline SBP or DBP, weight change, and clinic site as predictors. Baseline SBP or DBP was the strongest predictor of change (negative slope) in SBP or DBP at follow-up visits, suggesting regression toward the mean. As expected, weight change was associated with change in SBP or DBP (P<.01); however, the magnitude of the change was small, decreasing only 0.3 to 0.4 mm Hg (systolic and diastolic) per kg of weight lost. Decreases in waist circumference were not significantly associated with decreases in plasma glucose, but correlated with decreases in serum insulin levels. A one cm decrease in waist circumference was associated with a decrease of 0.14 μIU/mL in serum insulin (P<.001).

The data were also analyzed for possible confounding variables, including hormone replacement therapy (yes/no), alcohol intake (yes/no), and exercise (5 categories from "rare/never" to "about every day"). None of these covariates had a consistent trend that would modify interpretation of the primary study outcomes.

DISCUSSION

The primary focus of the dietary intervention was to decrease fat intake. The low-fat diet was not designed to be isocaloric, and no emphasis was placed on reduced calorie intake, weight loss, or exercise. The decreased fat intake, however, was accompanied by, and correlated with, the decrease in body weight. Some of the post-diet changes in clinical or metabolic parameters might, therefore, be associated with weight loss, rather than a low-fat diet *per se*. However, the decreases in reported calorie (538 kcal/day, from 1,834 kcal/day to 1,296 kcal/day, about 29%) and fat intakes (from 39.7% to 26.4% of total energy, about 34%) were large,

Table 2. Six-month changes in reported fat and energy intake, body weight, BMI, and waist-hip circumferences

		Intervention (I)		Control (C)		I–C	
Variable	**Ethnicity**	***N***	**Mean**	***N***	**Mean**	**Mean**	**95% CI†**
Fat (% energy)	All‡	1071	−13.3	649	−2.3	−11.0*	(−11.85, −10.17)
	White	623	−14.2	387	−2.3	−11.9*	(−12.97, −10.80)
	Black	330	−12.2	205	−1.5	−10.8*	(−12.28, −9.29
	Hispanic	109	−11.7	50	−6.0	−5.7*	(−8.52, −2.78)
Energy (kcal/d)	All	1071	−538	649	−171	−367*	(−441, −293)
	White	623	−496	387	−191	−306*	(−402, −210)
	Black	330	−510	205	−132	−379*	(−510, −247)
	Hispanic	109	−860	50	−166	−695*	(−948, −442)
Weight (kg)	All	1094	−1.8	646	−0.3	−1.5*	(−1.83, −1.13)
	White	631	−2.0	382	−0.5	−1.4*	(−1.90, −0.99)
	Black	335	−1.5	203	0.1	−1.7*	(−2.27, −1.02)
	Hispanic	118	−1.4	54	−0.3	−1.2	(−2.31, 0.00)
BMI (kg/m^2)	All	1094	−0.7	646	−0.1	−0.6*	(−0.70, −0.44)
	White	631	−0.8	382	−0.2	−0.6*	(−0.72, −0.38)
	Black	335	−0.6	203	0.1	−0.6*	(−0.88, −0.41)
	Hispanic	118	−0.6	54	−0.1	−0.5*	(−0.90, −0.03)
Waist (cm)	All	1094	−1.8	647	−0.1	−1.7*	(−2.14, −1.23)
	White	628	−2.0	382	−0.3	−1.7*	(−2.27, −1.08)
	Black	338	−1.4	204	0.5	−1.9*	(−2.71, −1.08)
	Hispanic	118	−1.6	54	−0.7	−0.9	(−2.44, 0.59)
Hips (cm)	All	1095	−1.8	648	−0.4	−1.4*	(−1.82, −0.97)
	White	629	−2.1	383	−0.4	−1.7*	(−2.22, −1.12)
	Black	338	−1.3	204	−0.4	−0.9*	(−1.67, −0.17)
	Hispanic	118	−2.1	54	−1.0	−1.0	(−2.43, 0.36)

* $P<.05$ for differences between the intervention and control group.
† 95% confidence interval for changes in the intervention group minus changes in the control group.
‡ ''All'' includes 3 to 10 individuals with unknown or other ethnicity.

Table 3. Six-month changes in blood pressure, fasting plasma glucose, and serum insulin level

		Intervention (I)		Control (C)		I–C	
Variable	**Ethnicity**	***N***	**Mean**	***N***	**Mean**	**Mean**	**95% CI†**
Systolic BP	All‡	1101	−3.1	648	−1.4	−1.7*	(−3.15, −0.32)
(mm Hg)	White	635	−4.2	383	−2.5	−1.7	(−3.57, 0.10)
	Black	338	−0.3	204	0.6	−0.9	(−3.38, 1.67)
	Hispanic	118	−5.1	54	−0.8	−4.4	(−9.03, 0.31)
Diastolic BP	All	1101	−1.1	648	−0.6	−0.4	(−1.17, 0.31)
(mm Hg)	White	635	−1.4	383	−0.8	−0.6	(−1.58, 0.36)
	Black	338	−0.3	204	−0.4	0.1	(−1.27, 1.38)
	Hispanic	118	−1.7	54	−0.8	−0.9	(−3.40, 1.52)
Plasma glucose	All	660	−0.2	407	−0.1	−0.1	(−0.18, 0.02)
(mmol/L)	White	381	−0.2	239	−0.2	0.0	(−0.17, 0.10)
	Black	193	−0.3	120	−0.1	−0.1	(−0.32, 0.05)
	Hispanic	81	−0.2	43	0.0	−0.2	(−0.46, 0.14)
Serum insulin	All	660	−0.5	406	0.3	−0.7	(−1.49, 0.03)
(ulU/mL)	White	380	−0.6	238	0.0	−0.6	(−1.62, 0.35)
	Black	194	0.0	120	1.1	−1.1	(−2.50, 0.27)
	Hispanic	81	−1.0	43	0.3	−1.4	(−3.61, 0.89)

* $P<.05$ for differences between the intervention and control group.
† 95% confidence interval for change in the intervention group minus change in the control group.
‡ ''All'' includes 3 to 10 individuals with unknown or other ethnicity.

whereas the reduction in body weight was small (from 75 kg to 73 kg, about 3%). Some degree of under-reporting of dietary calorie and fat intakes on the serially measured FFQs is likely, since the degree of weight loss was less than would be expected by the reported decrease in calorie intake. This occurred in both the intervention and control groups. Reducing dietary fat intake is further validated, however, by a greater 6-month reduction in plasma total cholesterol in the intervention (−7.8 mg/dL) vs the control group (−3.3 mg/dL).[13]

The weight loss associated with the low-fat intervention was 1.4 kg to 2.0 kg in White, Black, and Hispanic women, similar to that observed using a similar low-fat dietary intervention in the Vanguard Women's Health Trial.[21] In that study, a reduction in fat intake (from 39.2% to 21.6% of total energy) was associated with an average weight

loss of 3.1 kg at 6 months. The 303 participants in the Vanguard study were younger (mean age 55 vs 60 years), primarily White, middle-class women, at increased risk of breast cancer. Baseline weight was 68.0 kg in the Vanguard Trial, and 75.1 kg in WHT:FSMP Trial.

A waist circumference of >88 cm (35 in) in women is considered a risk factor for type 2 diabetes, hypertension, and cardiovascular disease.[10] In our cohort, circumferences this large were present in 39%, 51%, and 36%, of White, Black, and Hispanic women, respectively. The low-fat diet was associated with significant decreases in both waist and hip circumferences. The changes were proportionate, however, such that there was no change in the WHR following the intervention.

Net changes (I-C) in systolic or diastolic BP averaged −3.1 mm Hg and −1.1 mm Hg, respectively. Weight change was directly associated with change in BP. Several studies of decreased dietary fat intake in hypertensive individuals have also reported modest reductions in BP.[22] However, an 8-week combination diet (DASH, *N*=459) rich in fruits, vegetables, and low-fat dairy products (eg, milk) was recently shown to reduce blood pressure in both normotensive (5.5/3.0 mm Hg) and hypertensive (11.4/5.5 mm Hg) individuals.[23,24] In the DASH study, fat intake decreased from approximately 35.7% to 25.6% of total kcal. Body weight was kept stable (within 2% of baseline) by adjusting calorie intake regularly over the 8-week period. Our study showed much smaller decreases in BP than those found in the DASH study, despite a similar reported reduction in total fat intake, plus a small weight loss (75.1 kg to 73.3 kg at 6 months). Otherwise, the 2 studies are not comparable, however, because DASH was a short-term (8-week) study that decreased total and primarily saturated fat intake in relatively young men and women. In contrast, WHT:FSMP was a long-term intervention study that decreased total fat intake in postmenopausal women. Also, DASH prepared the food with many on-site meals, and was, therefore, associated with a very high adherence to the short-term diet. Servings per day of fruits and vegetables more than tripled in DASH, whereas the increase was much less (about 25%) in WHT:FSMP.[17] Thirty-nine percent of our study participants (mean age, 60 years) and 29% of DASH participants (mean age, 44 years) had elevated BP at the baseline examination.

WHT:FSMP documented that, in older women of diverse ethnic backgrounds, a 6-month low-fat diet was accompanied by a statistically significant, albeit modest, decrease in body weight and anthropometric indices . . .

The low-fat diet was associated with small decreases in plasma glucose and serum insulin that reached only borderline statistical significance. However, decreases in waist circumference correlated with decreases in serum insulin levels. Higher fasting insulin levels are associated with unfavorable levels of cardiovascular risk factors, including high levels of BP, triglycerides, and total and LDL cholesterol.[25] The long-term biological significance of borderline statistical decreases in insulin and glucose levels following the low-fat diet is unknown. Insulin levels are clustered with other cardiovascular risk factors and are more closely related to HDL-cholesterol and triglyceride levels, than to total, or LDL, cholesterol. In summary, WHT:FSMP documented that, in older women of diverse ethnic backgrounds, a 6-month low-fat diet was accompanied by a statistically significant, albeit modest, decrease in body weight and anthropometric indices, without specifically having targeted a reduction in calories.

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