

# Lack of Effect of a Low-Fat, High-Fruit, -Vegetable, and -Fiber Diet on Serum Prostate-Specific Antigen of Men Without Prostate Cancer: Results From a Randomized Trial

By Moshe Shike, Lianne Latkany, Elyn Riedel, Martin Fleisher, Arthur Schatzkin, Elaine Lanza, Donald Corle, Colin B. Begg, and the Polyp Prevention Trial Study Group

**Purpose:** To determine whether a diet low in fat and high in fruits, vegetables, and fiber may be protective against prostate cancer by having an impact on serial levels of serum prostate-specific antigen (PSA).

**Methods:** Six hundred eighty-nine men were randomized to the intervention arm and 661 to the control arm. The intervention group received intensive counseling to consume a diet low in fat and high in fiber, fruits, and vegetables. The control group received a standard brochure on a healthy diet. PSA in serum was measured at baseline and annually thereafter for 4 years, and newly diagnosed prostate cancers were recorded.

**Results:** The individual PSA slope for each participant was calculated, and the distributions of slopes were compared between the two groups. There was no significant difference in distributions of the slopes ( $P =$

.99). The two groups were identical in the proportions of participants with elevated PSA at each time point. There was no difference in the PSA slopes between the two groups ( $P = .34$ ) and in the frequencies of elevated PSA values for those with elevated PSA at baseline. Incidence of prostate cancer during the 4 years was similar in the two groups (19 and 22 in the control and intervention arms, respectively).

**Conclusion:** Dietary intervention over a 4-year period with reduced fat and increased consumption of fruits, vegetables, and fiber has no impact on serum PSA levels in men. The study also offers no evidence that this dietary intervention over a 4-year period affects the incidence of prostate cancer during the 4 years.

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PROSTATE CANCER is the most frequently diagnosed cancer in men in the United States, with an estimated incidence of 180,400 and mortality of 31,900 per year.<sup>1</sup> The diet has been implicated in the genesis and progression of prostate cancer. The role of the diet has been supported by international variations in incidence and mortality,<sup>2</sup> studies in migrants<sup>3-5</sup>, and the increase in prevalence of prostate cancer in several countries attributed to dietary changes.<sup>6</sup> Animal studies have also demonstrated the impact of diet on experimentally induced prostate cancer.<sup>7</sup> Ecologic studies<sup>8-10</sup> and case control studies<sup>11-16</sup> have shown positive correlations between dietary fat and prostate cancer mortality. Dietary fiber has been associated with decreased incidence.<sup>17,18</sup> Consumption of fruit and vegetables has been

shown in some studies to be protective, whereas it was not in others.<sup>19-22</sup>

This cumulative evidence led to the hypothesis that a diet low in fat and high in fruits, vegetables, and fiber may be protective against prostate cancer.<sup>15-20,22</sup> This hypothesis has not been vigorously tested in experimental human studies. To address this issue, we analyzed blood specimens from a randomized dietary intervention study to determine whether a reduction in dietary fat and an increase in the consumption of fruits, vegetables, and fiber affects the rate of change of serum prostate-specific antigen (PSA). The serum PSA is a marker that heralds the development of clinical prostate cancer and is used for its early detection.<sup>23-29</sup> We also compared the prostate cancer incidence during the study period.

## METHODS

### Study Design and Subjects

We used data and blood samples from the Polyp Prevention Trial (PPT), a multicenter randomized trial designed to evaluate the impact of a diet low in fat and high in fiber, fruits, and vegetables on the recurrence of colorectal adenomas.<sup>30-32</sup> Participants included men and women 35 years or older with one or more adenomas. They were randomized to an intervention or control group and followed annually for 4 years. Intervention group participants received intensive counseling for the following dietary goals: low fat (20% of total kcal), high fiber (18 g/1000 kcal), and high fruit and vegetable consumption (five to eight servings per day). They had more than 50 hours of individual

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From the Memorial Sloan-Kettering Cancer Center, New York, NY, and National Cancer Institute, Bethesda, MD

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Other members of the Polyp Prevention Trial Study Group are listed in the Appendix, available online at [www.jco.org](http://www.jco.org).

Address reprint requests to Moshe Shike, MD, Memorial Sloan-Kettering Cancer Center, 1275 York Ave, Box 224, New York, NY 10021; email: [shikem@mskcc.org](mailto:shikem@mskcc.org).

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and group counseling sessions throughout the study period. Control participants were provided with general dietary guidelines at baseline without any other nutrition information or counseling. At each annual visit, participants completed food records, food frequency questionnaires, and health and lifestyle forms and provided a fasting blood specimen. Dietary intake was estimated using the modified Block/National Cancer Institute Food Frequency Questionnaire (FFQ).<sup>33</sup> The PPT health and lifestyle data form included questions regarding medical history, hospitalization, and disease diagnoses. Cancer diagnoses at baseline and during the 4-year study period were obtained from the data form and from hospital records. Three 10-mL fasting blood samples were obtained at baseline and at each of the four annual visits. Serum and plasma were extracted and stored at a central repository at  $-80^{\circ}\text{C}$ . Randomly selected, 20% of participants' blood specimens were analyzed for cholesterol and serum carotenoids (ie, alpha-carotene, beta-carotene, lutein/zeaxanthin, cryptoxanthin, and lycopene).<sup>31</sup>

The PPT randomized 2,079 men and women. The study design and its results are described in detail elsewhere.<sup>30-32</sup> There were 1,351 male participants. The present study used all the study data for these males and analyzed a frozen serum sample from each participant for PSA at baseline and at four subsequent annual visits. We excluded patients with previous prostate cancer, and we excluded patients with less than two PSA measurements (Fig 1). In all other respects, the analysis uses an intent-to-treat basis. Data and blood samples for each participant were labeled with a new record number by the central data center to ensure anonymity of the results. The protocol was approved by the institutional review boards of Memorial Sloan-Kettering Cancer Center and the National Cancer Institute.

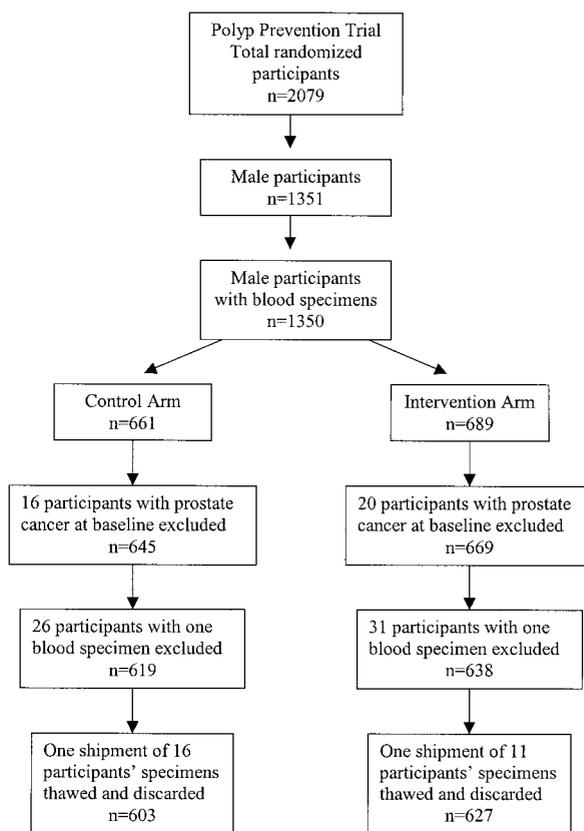
### Blood Collection and Analysis

Frozen serum specimens were received in our laboratory on dry ice and were maintained at  $-70^{\circ}\text{C}$  until analyzed. Coded specimen inventory listings were organized by subject so that all specimens from a particular subject could be identified and assayed at the same time thus eliminating the possibility of between-assay variability. Most subjects had five specimens that represented samples collected at baseline and at four subsequent annual visits.

Serum PSA concentration was measured by a heterogeneous sandwich magnetic separation assay using the Bayer Immuno 1 PSA assay (Bayer Diagnostics, Tarrytown, NY). The PSA assay has a detection limit of 0.05 ng/mL. The coefficients of variation for the assay at concentrations of 0.7, 2.8, and 17.9 ng/mL were 3.1%, 2.9%, and 0.6%, respectively. Samples with PSA values between 4 and 10 ng/mL were also analyzed for free PSA by a two-site immunoradiometric assay using monoclonal antibodies directed against distinct antigen sites on the free-PSA molecule (Hybritech, San Diego, CA). Free PSA below 15%, when the total PSA is between 4 and 10 ng/mL, enhances the PSA specificity.<sup>23</sup>

### Statistical Methods

This study was conceived while the PPT was ongoing. We developed a prospective protocol before performing the laboratory PSA assays to set out in advance the statistical analytic methods and data summaries that would be used and the hypotheses to be tested. We elected to use as a primary end point the slope of the PSA levels for each patient over the five time points from baseline to year 4, calculating linear regressions separately for each patient. In the 41 patients who were diagnosed with prostate cancer during the study, only the PSA values that preceded the diagnosis were used in calculating the PSA slope. The



**Fig 1. Participant inclusion flow chart. Analysis was based on the male participants from the PPT. The flow chart explains the derivation of the final number of participants used in the PSA analysis. Each box contains an inclusion or exclusion criterion and the number of participants remaining.**

distributions of these slopes were compared between the two treatment groups using a nonparametric statistical test (Wilcoxon/Mann-Whitney). This analysis has a power of 90% (5% significance, two-sided) to detect a difference in median PSA slopes of 0.04 ng/mL/yr. We present other comparisons of the PSA results for further testing of the dietary hypothesis, including subset analyses restricted to groups of patients at high risk of prostate cancer on the basis of baseline PSA and free-PSA levels. We also performed analyses in which these end points were compared after adjusting for factors that could influence the incidence of prostate cancer using linear regression and logistic regression techniques. We compared the frequency of prostate cancer, recognizing that the power to detect a meaningful difference in rates is limited in this study because of the relatively short intervention and follow-up. All reported *P* values are two-sided.

## RESULTS

### Characteristics of Participants

Of 2,079 participants in the PPT, 1,351 were males. The cohort for our study includes all male participants with blood samples ( $n = 1,350$ ). Six hundred eighty-nine men

**Table 1. Baseline Demographic, Behavioral, and Nutritional Characteristics of Participants**

	Control Arm	Intervention Arm
No. of participants (%)	661 (49)	689 (51)
Age, years	61.7 ± 0.36	61.8 ± 0.37
Family history of prostate cancer, %	6.2	6.9
Minority race or ethnic group, %	10	12
More than high school education, %	77	77
Current smoker, %	14	12
Alcohol intake, drinks/wk	4.7 ± 0.26	4.2 ± 0.23
Body mass index*	27.9 ± 0.14	27.9 ± 0.14
Calories, kcal/d	2,114 ± 24.4	2,078 ± 22.2
Fat, % of calories	36.5 ± 0.28	35.9 ± 0.25
Fiber, g/1,000 kcal	9.0 ± 0.14	9.7 ± 0.15
Fruits and vegetables, servings/d†	3.6 ± 0.06	3.8 ± 0.06
Prostate cancer incidence at or before baseline (%)‡	16 (2.4)	20 (2.9)

NOTE. Plus-minus values are mean ± SE.

\*Body mass index is calculated as the weight in kilograms divided by the square of the height in meters.

†A serving of a vegetable is ½ cup raw, canned, or cooked, 1 cup leafy raw, one medium vegetable, or for legumes, it is ¼ cup; a serving of fruit is ½ cup raw, canned, or cooked, ¼ cup dried, or one medium fruit; servings do not include juices. These intakes are comparable to the intake reported by the USDA for men > 50 years old.<sup>39</sup>

‡These participants were excluded from the PSA analysis.

were randomized to the intervention arm and 661 to the control arm.

Participants' characteristics (Table 1) were comparable in the two groups. Prostate cancer risk factors such as age, diet, race, body mass index, and family history of prostate cancer were well balanced. Thirty-six participants had a previous history of prostate cancer at baseline (16 in the control arm and 20 in the intervention arm). These were excluded from subsequent PSA analysis. Further exclusions are presented

in Fig 1. Consequently, the analysis is limited to 1,230 participants (603 on the control arm and 627 on the intervention arm) (Fig 1).

#### Changes in Diet, Weight, and Biomarkers

As previously reported,<sup>32</sup> the intervention was effective in altering the diet. Table 2 lists dietary intake (from the FFQ), weight, and serum markers at baseline and at year 4. Dietary changes were generally made within the first year in

**Table 2. Changes Over Time in Dietary Intake, Weight, and Biomarkers**

	Control Arm		Intervention Arm		Absolute Difference in Change Between Groups	95% CI*
	Baseline (n = 603)	Year 4 (n = 566)	Baseline (n = 627)	Year 4 (n = 580)		
<b>Intake</b>						
Fat, % calories	36.5 ± 0.29	34.3 ± 0.31	35.7 ± 0.26	23.7 ± 0.28	-9.9	-10.6 to -9.1
Fat, g	86.6 ± 1.40	78.3 ± 1.26	83.1 ± 1.26	52.2 ± 0.87	-22.2	-25.6 to -18.9
Fiber, g/1,000 kcal	9.0 ± 0.15	9.7 ± 0.17	9.7 ± 0.16	17.2 ± 0.24	7.0	6.4 to 7.5
Fiber, g	18.5 ± 0.31	19.1 ± 0.34	19.5 ± 0.33	34.1 ± 0.57	14.2	13.0 to 15.4
Fruits and vegetables, servings/d	3.6 ± 0.07	3.9 ± 0.08	3.8 ± 0.07	6.4 ± 0.10	2.3	2.1 to 2.5
Lycopene, µg	4,394 ± 190	4,836 ± 227	4,950 ± 222	6,981 ± 298	1,666	942 to 2,390
Calories, kcal	2,114 ± 25.4	2,032 ± 22.8	2,072 ± 23.5	1,983 ± 19.5	2.1	-59.6 to 63.9
Weight, lb†	191.4 ± 1.1	192.1 ± 1.2	191.7 ± 1.2	190.3 ± 1.3	-2.1	-3.4 to -0.7
<b>Serum biomarkers, µg/dL</b>						
Alpha-carotene	5.7 ± 0.26	5.6 ± 0.26	6.1 ± 0.30	6.9 ± 0.34	0.8	0.1 to 1.5
Lutein/zeaxanthin	24.9 ± 0.68	25.3 ± 0.73	24.9 ± 0.66	27.2 ± 0.82	1.8	0.1 to 3.5
Lycopene	24.1 ± 0.63	22.7 ± 0.69	23.6 ± 0.68	21.6 ± 0.68	-1.3	-3.1 to 0.6

NOTE. Plus-minus values are mean ± SE.

Abbreviation: CI, confidence interval.

\*Differences were calculated only for subjects who had values at baseline and at Year 4.

†To convert values for weight to kilograms, divide by 2.2.

**Table 3. Outcomes (1,230 participants)**

	Control Arm		Intervention Arm	
	Value	95% CI	Value	95% CI
No. of participants at baseline		603		627
Participants with four or five PSA values, %		87		89
PSA slope*	0.034	0.025-0.046	0.033	0.023-0.041
Test for difference in slopes†				<i>P</i> = .99
Participants with observed PSA ≥ 4 ng/mL, %‡				
Baseline	11	9.0-14	12	9.2-14
Year 1	12	9.7-15	13	11-16
Year 2	12	9.8-15	14	11-17
Year 3	13	10-16	13	10-16
Year 4	13	11-16	13	10-16
Participants with observed PSA ≥ 10 ng/mL, %‡				
Baseline	1.8	0.9-3.2	1.1	0.5-2.3
Year 1	1.7	0.8-3.1	2.0	1.0-3.4
Year 2	2.5	1.4-4.2	2.5	1.4-4.1
Year 3	2.4	1.3-4.1	2.2	1.1-3.8
Year 4	2.5	1.3-4.2	2.2	1.1-3.8
No. of participants diagnosed with prostate cancer (%)				
Year 1		6 (1.0)		3 (0.5)
Year 2		2 (0.3)		6 (1.0)
Year 3		2 (0.4)		7 (1.2)
Year 4		9 (1.6)		6 (1.0)

\*Median with 95% confidence interval. Analysis is based upon participants with three or more PSA values.

†Slope analysis is based upon participants with three or more PSA values.

‡Percentage of participants with 95% confidence interval.

the intervention arm and remained fairly constant subsequently. As listed in Table 2, the intervention group participants reduced their fat intake significantly and increased their fiber, fruits, vegetables, and lycopene intake significantly compared with the control participants. Caloric intake did not change significantly in either the intervention or control arms. The intervention group had significant weight reduction compared with the control group with the absolute difference in change amounting to  $-4.5$  lb (95% confidence interval [CI],  $-5.47$  to  $-3.54$  lb) at year 1,  $-3.5$  lb (95% CI,  $-4.56$  to  $-2.3$  lb) at year 2,  $-2.8$  lb (95% CI,  $-4.9$  to  $-2.6$  lb) at year 3, and  $-2.1$  lb (95% CI,  $-3.44$  to  $-0.67$  lb) at year 4. The absolute difference in serum cholesterol change showed a significant reduction in the intervention arm at year 1 (difference,  $-4.4$  mg/dL; 95% CI,  $-8.23$  to  $-0.58$  mg/dL). Although the reduction persisted, it was not significant in subsequent years. As summarized in Table 2, there was a significant increase in serum levels of lutein/zeaxanthin and alpha-carotene in the intervention group. There were no significant changes in the other serum carotenoids (data not shown).

#### Changes in Serum PSA

For the primary outcome analysis, we calculated the individual PSA slope for each participant and compared the

distribution of the slopes between the two groups. Participants with only two specimens (25 in the control arm and 36 in the intervention arm) were excluded from this analysis because the slope estimates for these participants would be highly variable; exclusion of these participants had no impact on the overall results. These distributions of slopes in the two groups were similar (Table 3). The median slope in the intervention arm was  $0.033$  ng/mL/yr (95% CI,  $0.023$  to  $0.041$  ng/mL/yr), whereas in the control arm, it was  $0.034$  ng/mL/yr (95% CI,  $0.025$  to  $0.046$  ng/mL/yr). The difference in slopes was not significant ( $P = .99$ ). Table 3 lists other comparisons that illustrate the absence of impact of the intervention. The percentage of participants with PSA greater than  $10$  ng/mL increased from  $1.8\%$  to  $2.5\%$  in the control arm and from  $1.1\%$  to  $2.2\%$  in the intervention arm. The percentage of participants with PSA greater than  $4$  ng/mL increased from  $11\%$  to  $13\%$  in the control arm and from  $12\%$  to  $13\%$  in the intervention arm. We further performed a series of analyses in which these end points were compared after adjusting for the factors listed in Table 1 using linear or logistic regression as appropriate. In all cases, the adjustments had no effect on the comparability of the outcomes by treatment (data not shown). Finally, we performed an analysis in which the treatment effect and the

Table 4. Outcomes for Participants with Elevated PSA at Baseline (142 participants)

	Control Arm		Intervention Arm	
	Value	95% CI	Value	95% CI
No. of participants at baseline	69		73	
Participants with four or five PSA values, %	93		88	
PSA slope*	0.11	-0.02-0.49	0.30	0.12-0.57
Test for difference in slopes†		$P = .34$		
Participants with observed PSA $\geq$ 4 ng/mL, %‡				
Baseline	100		100	
Year 1	73 (49/67)	61-83	88 (64/73)	78-94
Year 2	65 (42/65)	52-76	80 (55/69)	68-88
Year 3	68 (43/63)	55-79	70 (45/64)	58-81
Year 4	62 (39/63)	49-74	65 (39/60)	52-77
Participants with observed PSA $\geq$ 10 ng/mL, %‡				
Baseline	16 (11/69)	8.2-27	10 (7/73)	3.9-19
Year 1	15 (10/67)	7.4-26	16 (12/73)	8.8-27
Year 2	22 (14/65)	12-33	20 (14/69)	12-32
Year 3	19 (12/63)	10-31	19 (12/64)	10-30
Year 4	21 (13/63)	11-33	17 (10/60)	8.3-29
No. of participants diagnosed with prostate cancer (%)				
Year 1	3 (4.3)		1 (1.4)	
Year 2	1 (1.5)		5 (7.1)	
Year 3	1 (1.5)		7 (10)	
Year 4	5 (7.5)		2 (3.1)	

\*Median with 95% confidence interval; analysis is based upon participants with three or more PSA values.

†Slope analysis is based upon participants with three or more PSA values.

‡Percentage of participants with relative frequencies and 95% confidence interval.

random effects representing the slopes and intercepts of each patient were modeled simultaneously and where missing PSA values were imputed on the basis of the assumption that the absence of data was not related to outcome.<sup>34</sup> This analysis also showed no effect of treatment ( $P = .67$ )

Although not a primary end point of the study, the incidence of prostate cancer was similar in the two groups. Nineteen control group and 22 intervention group participants were diagnosed with prostate cancer. The rate ratio of prostate cancer incidence for the control group versus the intervention group was 0.89 (95% CI, 0.48 to 1.64). The PSA trajectories for the participants who developed prostate cancer were typically strongly positive with a decrease to zero or close to zero after diagnosis, most likely reflecting treatment effect. A few participants had low measures of PSA for the entire study period. There was no apparent difference in PSA trajectories between the treatment groups for those participants who developed prostate cancer.

It can be argued that the participants with nonelevated PSA at the outset are at low risk for prostate cancer and thus would be unlikely to be affected by dietary changes. To address this concern, we performed a subset analysis, restricted to those participants with elevated PSA at baseline, which was defined as PSA more than 4 ng/mL. The results of this analysis are summarized in Table 4. Sixty-

nine of 603 participants in the control arm had an elevated PSA at baseline compared with 73 of 627 participants in the intervention arm. The patterns of subsequent PSA values are again similar. The test for a difference in PSA slopes was not significant ( $P = .34$ ). The fact that the percentages of this subgroup with elevated PSA decreases (for both treatments) over time is likely to be due, in part, to regression to the mean.

A further subset analysis of high-risk subjects was conducted in recognition of the fact that men with elevated PSA but a low ratio of free to total PSA are at higher risk of cancer, whereas in those with a high ratio, the elevated PSA is more likely to be due to benign causes. This analysis included all men whose baseline PSA was greater than 10 ng/mL and additionally those men whose baseline PSA was in the range of 4 to 10 ng/mL and whose free/total PSA ratio was less than 0.15. This constituted the group with high risk for prostate cancer based on PSA. There were 96 men in this subset (43 in the control group and 53 in the intervention group), and again the intervention and the control groups exhibited a similar pattern of subsequent PSA values with median slopes of 0.35 and 0.33 in the control and intervention groups, respectively ( $P = .95$ ). Thus, in this high-risk group for prostate cancer, no impact of the diet was seen.

## DISCUSSION

In this 4-year randomized study, a low fat, high fiber diet, enriched with fruits and vegetables, had no effect on the slope of the serum PSA in all subjects in the trial, as well as in the subgroup with an elevated PSA at baseline. Serum PSA is an important marker for prostate cancer, and elevated levels are used to detect clinically silent prostate cancer.<sup>23-29</sup> The onset and growth of prostate cancer is typically accompanied by increasing serum levels of PSA, as is the growth of metastases.<sup>23-29</sup> Thus, it is reasonable to assume that any intervention that is effective in delaying or preventing prostate cancer would be likely to have a corresponding impact on the serum PSA levels. The study offers an unusual opportunity to evaluate the relationship between PSA levels and prostate cancer incidence in that all of the serial PSAs were performed retrospectively and anonymously and thus had no effect on clinical decisions to perform biopsies and so on, although we recognize that some of these patients would have had PSA tests in the normal course of events during the study period. Of the 41 patients who were diagnosed with prostate cancer during the study, 32 had a PSA more than 4 ng/mL immediately before the diagnosis, indicating a sensitivity of 78%. Of these 32 patients, 20 had values between 4 ng/mL and 10 ng/mL, and 12 had values greater than 10 ng/mL. Among the remaining patients not diagnosed with prostate cancer, 6.5% of the PSA values were greater than 4 ng/mL. The inclusion/exclusion criteria of the PPT<sup>32</sup> are not likely to have affected the results of this study because none are known to be correlated with serum PSA levels or prostate cancer.

The dietary assessment results indicate that the diets of the intervention and control groups were clearly different, with the intervention group consuming significantly less fat and more fruits, vegetables, and fiber during the trial. Although the weaknesses of dietary assessments have been reported,<sup>35,36</sup> this study was designed to limit the errors of under-reporting intake and interviewer bias. To reduce the underestimation of calories in food intake questionnaires,<sup>35</sup> the FFQ was modified to include high fiber, low-fat, and non-fat foods.<sup>31</sup> The FFQ was reviewed with the participants by nutritionists trained and certified on the tool. Additionally, intervention participants' FFQs were reviewed by nutritionists not providing the dietary counseling.

The significant absolute difference in changes in the body weight throughout the 4 years also suggests the achievement of the dietary goals.<sup>37</sup> Further evidence for the success of the dietary intervention comes from the serum cholesterol, which showed a significant reduction in the intervention group compared with the control at year 1, although not later in the study. Dietary lycopene intake increased signif-

icantly in the intervention group, however there was no significant increase in the serum lycopene levels. This could be due to consumption of food with low bioavailable lycopene (such as raw tomatoes and tomato juice), as well as the low fat intake.<sup>38</sup> The intervention group also demonstrated an increase in lutein/zeaxanthin and alpha-carotene serum levels, indicating increased intake of fruits and vegetables.<sup>39</sup>

The failure of the intervention to alter the distribution of PSA levels cannot be interpreted as definitive evidence that the diet has no role in prostate cancer prevention. The PSA is a surrogate marker, and it is possible that the study diet could reduce the occurrence and growth of prostate cancer without affecting the serum PSA. A definitive study would necessarily compare the incidence and mortality rates of prostate cancer with high statistical power. Our study had only limited power to evaluate cancer incidence, but the similar rates of diagnosis of prostate cancer (22 in the intervention group v 19 in the control group) offer no evidence that the intervention had an impact (rate ratio, 0.89; 95% CI, 0.48 to 1.64). Another limitation of the study is the fact that the intervention duration, 4 years, is relatively short in the context of the lifetime of the participant and the length of the process of carcinogenesis. It is thus possible that a longer intervention beginning earlier in life, or indeed a longer follow-up of the patients in this study, would ultimately lead to an observable beneficial impact. Epidemiological studies that examine the role of the diet on cancer incidence usually report on diets that have been consumed throughout the lifetimes of the subjects. Thus, a beneficial dietary pattern may need to be in effect for many years to have an inhibitory effect on cancer. Also, even though dietary fat, fruits, vegetables, and fiber have been specifically found in epidemiology and animal studies to be protective, it is possible that other dietary factors such as soy and a variety of nutritive and non-nutritive dietary components, not specifically included in the intervention diet in this study, could exert a protective effect. It is also possible that the diet could impede the progression of prostate cancer without affecting its early stages. The design of this study does not address these issues. The current multicenter Selenium and Vitamin E Cancer Prevention Trial is examining the affect of supplementation with these two nutrients on prostate cancer prevention.

This study did not demonstrate a beneficial effect from a low-fat diet high in fruits, vegetables, and fiber on the serum PSA. Nevertheless, the general dietary recommendations based on these patterns have merit, because a diet that is low in fat and high in fruits, vegetables, and fiber has numerous other health benefits.

## APPENDIX

The appendix listing the members of the Polyp Prevention Trial Study Group is available online at [www.jco.org](http://www.jco.org).

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