Published in final edited form as:

J Acad Nutr Diet. 2012 November ; 112(11): 1822–1827. doi:10.1016/j.jand.2012.06.008.

A Novel Measure of Dietary Change in a Prostate Cancer Dietary Program Incorporating Mindfulness Training

James F. Carmody, Ph.D. [Associate Professor of Medicine],

Division of Preventive and Behavioral Medicine, University of Massachusetts Medical School, 55 Lake Avenue North, Worcester, MA 01655., 508-856-1205 (phone), 508-856-2022 (fax)

Barbara C. Olendzki, MPH, R. D [Assistant Professor of Medicine],

Division of Preventive and Behavioral Medicine, University of Massachusetts Medical School, 55 Lake Avenue North, Worcester, MA 01655., 508-856-5195 (phone), 508-856-2022 (fax)

Philip A. Merriam, MSPH [Assistant Professor of Medicine],

Division of Preventive and Behavioral Medicine, University of Massachusetts Medical School, 55 Lake Avenue North, Worcester, MA 01655., 508-856-5848 (phone), 508-856-2022 (fax)

Qin Liu, MD, Ph.D. [Associate Professor],

The Wistar Institute, Philadelphia, PA 19104

Yongxia Qiao, MD [Research Associate], and

Division of Preventive and Behavioral Medicine, University of Massachusetts Medical School, 55 Lake Avenue North, Worcester, MA 01655., 508-856-1516 (phone), 508-856-2022 (fax)

Yunsheng Ma, MD, Ph.D. [Associate Professor of Medicine]

Division of Preventive and Behavioral Medicine, University of Massachusetts Medical School, 55 Lake Avenue North, Worcester, MA 01655., 508-856-1008 (phone), 508-856-2022 (fax)

James F. Carmody: James.Carmody@umassmed.edu; Barbara C. Olendzki: Barbara.Olendzki@umassmed.edu; Philip A. Merriam: Philip.Merriam@umassmed.edu; Qin Liu: qliu@Wistar.org; Yongxia Qiao: Yongxia.Qiao@umassmed.edu; Yunsheng Ma: Yunsheng.Ma@umassmed.edu

Abstract

Diet may represent a modifiable prostate cancer (CaP) risk factor, but a vegetable-based prostate-healthy diet is a major change for most men. We used a ratio of animal:vegetable proteins (A:V ratio) to evaluate whether a comprehensive dietary change was self-sustaining following completion of 11 weekly dietary and cooking classes that integrated mindfulness training (MT). Thirty-six men with recurring CaP were randomized to the intervention or wait-list control. Assessments were at baseline, three months and six months. Of the 17 men randomized to the intervention, 14 completed the requirements. Nineteen were randomized to control and 17 completed requirements. Compared to controls, a significant post-intervention (3 months) decrease in A:V ratio in the intervention group ($p=.01$) was self-maintained 3 months post-intervention ($p=0.049$). At each assessment, the A:V ratio was correlated with lycopene, fiber,

©2012 Academy of Nutrition and Dietetics. Published by Elsevier Inc. All rights reserved.

Corresponding author: Dr. Yunsheng Ma, Division of Preventive and Behavioral Medicine, Department of Medicine, University of Massachusetts Medical School, 55 Lake Avenue North, Worcester, MA 01655, 508-856-1008 (phone), 508-856-2022 (fax), Yunsheng.Ma@umassmed.edu.

Address reprint requests to Dr. Yunsheng Ma, Division of Preventive and Behavioral Medicine, Department of Medicine, University of Massachusetts Medical School, 55 Lake Avenue North, Worcester, MA 01655

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

saturated fat, and dietary cholesterol; four dietary components linked to clinically relevant outcomes in CaP. Change in A:V ratio was also significantly correlated with changes in fiber, saturated fat and dietary cholesterol intake. Participants reported regular MT practice and there was a significant correlation between MT practice and changes in both initiation and maintenance of the change in the A:V ratio. These pilot results provide encouraging evidence for the feasibility of a dietary program that includes MT in supporting dietary change for men with recurrent CaP and invite further study to explore the possible role of MT as a means of supporting both initiation of dietary changes and maintenance of those changes over time.

Keywords

diet; maintenance; prostate cancer; clinical trial; mindfulness

INTRODUCTION

Interventions addressing health-related behaviors hold considerable promise for ameliorating adverse sequelae of cancer and its treatment(1). Evidence strongly implicates diet as a factor in the development and progression of prostate cancer (CaP) and in the present debate on the mixed benefits of routine screening for CaP and immediate treatment for all men diagnosed(2–6), diet change may represent an important modifiable risk factor(7–9). As such it may be a valuable self-care cancer survivorship strategy and give some sense of personal control and hope to men(10).

Increased CaP risk appears to be associated with saturated fat from animal sources, milk and other dairy products, and meat (particularly red and processed meat), while intake of whole grain cereals, foods such as tomatoes that contain lycopene, plant foods containing phytoestrogens, vegetables, and fatty fish (with beneficial fatty acids) appear potentially protective(7, 11–20). Unfortunately, this predominantly vegetable-based diet(7) is atypical for American men most at risk for CaP (over age 65) and supporting them in making such a change presents several challenges: Only 28% of CaP survivors adhere to the American Cancer Society recommended five servings of fruit and vegetables/day(21) and are less likely than other cancer patients to initiate or maintain diet and lifestyle changes following diagnosis(22, 23); Changing to a predominantly vegetable-based diet significantly impacts habits of shopping, food preparation and attendant social and familial patterns; Males in this age range are not centrally involved with food purchasing and preparation(24), and are often reliant upon family members or restaurants for their daily food. Recognizing these challenges, most trials of comprehensive dietary change for CaP patients have been feeding trials with prepared food supplied by study personnel(18, 25–31).

We developed and tested the feasibility of a relatively short-term, group-based comprehensive dietary change program (including the men's partners) that included shopping for and preparing prostate-healthy meals(32). To support the process of change and maintenance, mindfulness training (MT) was integrated into the program. Mindfulness is a learned capacity to attend to and discriminate between physical sensations, perceptions, affective states, thoughts and imagery in a non-reactive way(33, 34). It is associated with increased awareness of everyday activities and increases through formal practice(35). In a dietary change context, the participant learns to approach the apparent seamlessness of reactions to particular foods by recognizing the difference between the actual sensations of taste of the food, and their thoughts and feelings about it. The capacity to distinguish these components of experience and be non-reactive to them also supports the participant in maintaining their changes in the face of impulses to abandon their goal. This increased awareness of taste and other related sensations, feelings and cognitions has been shown

supportive of changes in dietary practices(36). If effective, a program such as this would represent an important resource for men either during watchful waiting, or for CaP recurrence.

The aim of the present study was to obtain preliminary data on whether changes to a vegetarian dietary style were self-sustaining following completion of the intervention. The challenge of establishing an adequate summary measure of change in comprehensive dietary interventions has been addressed in a number of ways including the Healthy Eating Index(37) and Alternative Healthy Eating Index(38). It was expected that reducing meat consumption would be the most significant challenge in changing to the prostate-healthy dietary pattern, so our outcome measure was the consumption ratio of land animal protein to vegetable protein (A:V ratio). The A:V ratio was considered preferable as the outcome measure in the present study because it captures the dietary components of interest while leaving further analyses to tease out the various weighted importance of each. This ratio was previously used by Kapiszewska et al., in a large epidemiological study as an indicator of dietary-protection in colon, breast, and prostate cancer incidence(39). A higher incidence of those cancers was found in countries where the ratio was higher and suggested that it was a better method to examine cancer-related dietary patterns than focusing on individual dietary components. To closely reflect the dietary evidence related to CaP and to reflect overall change in our participants' dietary patterns to the prostate-healthy diet, we adapted the ratio to include fish with protective vegetable proteins in the denominator. To our knowledge, no clinical trial has integrated MT into an intervention to support dietary change, or assessed a prostate-healthy diet using this ratio to reflect change in each of the components important to prostate health.

METHODS

Participants

Participants were 36 men with biopsy-confirmed CaP who had undergone primary treatment (radical prostatectomy, radiation or seed implantation) and had a subsequent rising PSA (two rising PSA levels on at least two sequential tests after achieving a post-treatment nadir). Participants were recruited from within central Massachusetts, including referrals from urologist, oncologists, primary care physicians (30 participants), CaP support groups (2), direct mail campaign (2), Massachusetts Prostate Cancer Symposium (1), and radio public service announcements (1).

Exclusion criteria included undergoing radiation, chemotherapy, or hormonal therapies currently or within six months prior to the intervention; debilitating medical problems such as Alzheimer's; dietary restrictions limiting participation, such as renal disease, inflammatory bowel disease, or following a specific diet. Participation was voluntary, and did not affect or replace the men's medical care.

Participants were strongly encouraged to have their spouse or someone with whom they share meals to partner them through the intervention, although they were not excluded if this was not possible. The protocol was approved by University of Massachusetts Medical School (UMMS) Institutional Review Board.

Baseline information was obtained before randomization to the intervention or control arm. The controls received their usual medical care with the option of the intervention program at study completion. Participation lasted 6 months: assessments were at baseline, three months (immediate post-intervention) and six months (three months post-intervention). Baseline visits took place between one and three weeks before beginning the intervention, and post-intervention assessments were within one week of the final class.

Dietary Change Program

The program consisted of eleven weekly 2½-hour classes held in the UMMS Prevention Institute teaching kitchen and the attached conference room. The prostate healthy diet was based upon increasing consumption of plant-based foods and oily fish and included a wide variety of vegetables and fruit (emphasis on cruciferous varieties and tomatoes), whole grains and soy foods, and reducing or eliminating land animal-based protein including dairy(7).

Each class integrated didactic and experiential components. Participants learned to shop for and cook meals conforming to the study diet, including foods that may have been unfamiliar. At each class, participants prepared and cooked a study-compliant meal which they then ate together family-style in the adjacent conference room. Foods containing phytoestrogens, lycopene, other carotenoids and fiber were especially encouraged, as these dietary components appear to be protective in CaP(40–43). Vegetable protein was derived from nuts, seeds, legumes and soy foods, cereal foods, and other vegetables (these foods are nutrient dense, also containing fiber, beneficial fatty acids, carotenoids and other phytonutrients). Classes focused on the reduction of saturated fats rather than total fat consumption, since saturated fats are associated with increased CaP risk.

Formal mindfulness training (MT)(44) was incorporated and integrated into each class and included 15 minutes of sitting meditation and mindful body-stretching exercises. Instructor-led discussion supported using the developing mindful awareness to attend to the tastes, flavors, textures and aromas of foods consumed in class and to use their increasing discrimination to distinguish these from any reactions, thoughts and habitual judgments concerning these and other food choices so that their old patterns did not determine the suitability and acceptability of these new foods for integration into their lifestyle. Participants were encouraged to bring this spirit of enquiry to their thoughts and feelings about the dietary change process itself, including any memories and feelings of loss of familiar foods and their associations. Rather than trying to change these reactions, participants were encouraged to accept them as they were, while at the same time not having them occupy their attention and determine their food choices.

Participants kept food records which were reviewed for balance and objectives by study dietitians. They also received a study manual containing nutritional information relevant to the material covered in each class, a cookbook containing recipes for a wide variety of study-compliant meals and snacks, and a CD containing mindfulness practice instructions that they were encouraged to listen to daily at home.

Control participants continued usual care with their physician, and had the option of participating in a post-study series of the intervention classes and/or receiving all the study intervention materials at the completion of study participation.

Measures

At each time point, PSA, body weight and quality of life were measured. Results of these are described elsewhere(45).

Dietary Intake was assessed using the 24-Hour Dietary Recall Nutrition Data System for Research (NDS-R version 4.03_31)(46) at each time point through three unannounced phone calls at each of the assessment time points. Calls were made on two week-days and one weekend day on randomly selected days, by a trained registered dietitian (RD) blinded to subjects' group designations(47). The NDS-R food database includes nutrient ratios (such as animal and vegetable protein intake) and other food components including soluble and insoluble fiber, carotenoids, other antioxidants and phytoestrogens. Since dietary data was

collected from three days at each follow-up time point, the A:V ratio was calculated using the average of the three days: land animal protein intake (including dairy) divided by the average of the three days vegetable and fish protein intake.

Mindfulness Practice was represented by the number of minutes intervention participants spent each day in out-of-class formal mindfulness practice during the six-month study period.

Statistical Analysis

The primary outcome was the ratio of protein intake from land animal versus that from vegetable and fish (A:V ratio). Differences at baseline and differences in the changes from baseline at each follow-up time-point were compared between intervention and control using t-tests for comparing means of continuous variables. Daily caloric intake, animal protein, vegetable protein, and A:V ratio were compared between intervention and control using random effects mixed models. The interaction term of group assignment and time was tested using a likelihood ratio test to determine if there was a difference in the change over time in any outcome between intervention and control. Models were examined using all data collected, as well as models that restricted analyses to patients with data at all three time-points, inferences were not different between the two analyses, therefore results are shown for analyses using all data collected.

Pearson correlation coefficients were used to estimate associations of A:V ratio with other nutrients, PSA and other laboratory biomarkers at each time point, and changes in the ratio from baseline to 3 months and 6 months with change in other nutrients and biomarkers at corresponding time periods. Associations between A: V ratio and mindfulness practice reported in the intervention group were similarly examined.

RESULTS AND DISCUSSION

Participants' Characteristics

Participants were primarily non-Hispanic White Men (91%). The average age was 69.1 years old (SD=9.0) and average weight 200.8 lbs (SD=32.1) with an average BMI of 30.1 kg/m² (SD = 4.4). Ninety one percent were married or partnered, and 40% reported a family history of prostate cancer. Average length of time since primary treatment was 5.3 years (SD=3.0).

At baseline, there were no significant differences between the two groups on dietary or physical activity variables, age or BMI. Of the 17 men randomized to the intervention condition, 14 completed the dietary study intervention requirements (attended 7 or more classes, completed baseline, post-intervention and follow-up measurements). Nine (64%) of the 14 intervention participants who came to the classes brought a support person (spouses). Nineteen men were randomized to the control condition and 17 completed the dietary study control requirements (completed the three assessments). Of the 2 men who did not complete, 1 found the study requirements too demanding and 1 objected to his randomization assignment. Eleven (58%) of the control participants chose to attend the program classes after their final assessment and all were accompanied by a support person. Seven men decided to pursue hormone therapy during the course of their participation, 4 in the intervention and 3 in the control arm.

Dietary Outcomes

Results from animal protein, vegetable protein, and A:V ratio for each of the study time points are shown in Table 1. Immediately post-intervention, the A:V ratio had decreased

significantly in the intervention group, indicating a move away from animal proteins, and dropped steadily from 1.87 at baseline to 0.96 post-intervention ($p=.01$) and 0.86 six months from baseline ($p=.05$). The control group's ratio increased slightly from 2.55 at baseline to 3.00 six months post-baseline ($p=0.025$). In the intervention group, vegetable protein intake increased significantly ($p=.007$) and animal protein (which included dairy products) reduced significantly ($p=.02$). Importantly, these changes were self-maintained three months post-intervention, without further contact or support from study personnel.

At baseline, animal protein and dairy were the largest sources of saturated fat in the men's diet, and the reductions in those foods were associated with significant reductions in saturated fats. We also found significant correlations of the A:V ratio with fiber ($p=0.004$ at baseline, $p=0.001$ at 3 months, and $p=0.006$ at 6 months). Lycopene was significant at 3 months visit, with the highest intake of lycopene in the intervention group ($p=0.022$). Saturated fat and cholesterol, both found in dairy and animal proteins, remained significant at both time points.

Reported Mindfulness Practice

At six months, sixty-five percent of intervention men reported regular out-of-class mindfulness practice (average 12.3 minutes/day). Pearson correlations found a significant relationship between mindfulness practice and increases in percent vegetable protein intake ($p=.009$) and animal protein reduction ($p=.04$). These relationships may reflect a 'good patient' phenomenon (i.e.; those who adhered to the dietary changes also adhered to the other intervention demands) but also may indicate the usefulness of MT in supporting dietary change. No significant correlations were found between the A:V ratio and the minutes of reported mindfulness practices.

Discussion

While a number of trials have studied the effect of minor dietary changes such as nutritional supplements to reduce CaP risk (48) the evidence strongly suggests that it is an overall dietary change that is most protective. Because of the unique and formidable challenges of supporting dietary change in the CaP population outlined in the introduction, studies of radical dietary change on disease risk have not attempted to give responsibility for the change to the men themselves. They have addressed the problem by taking the men to a spa(49), or having prepared food delivered to the men's homes(25, 50). Those that have required the men to prepare the food at home used numerous individual sessions with dietary counselors over an extended period of time(31, 51). Neither of these strategies is feasible for large numbers of men. And while the utility of mindfulness in health behavior change is receiving considerable attention(52), to our knowledge this is the first intervention to integrate MT to support the process of dietary change and maintenance. Moreover, the average PSA doubling time (a clinical marker of disease progression) of men in the intervention slowed from 21 months at baseline to 58 months six months later. The controls remained unchanged at 18 months at both time points.

Finally, approximately 36% of patients with CaP can be expected to have concurrent cardiovascular disease and/or diabetes(53, 54) and causes of death among CaP patients not dying of the disease are similar to those among non-CaP decedents(55). In this respect, a 'prostate-healthy' diet is one likely to also be beneficial for risk factors for cardiovascular diseases and diabetes(56, 57).

The study was limited by the small sample size, and the fact that it was predominantly non-Hispanic White means that it may not be generalizable to other races/cultures, especially African American men who are at increased risk for CaP.

CONCLUSIONS

In this intervention which included MT and the support of some partners, men with a CaP recurrence made the significant changes to a vegetable-based diet; changes that were maintained three months later without additional intervention or program support. Given the controversy concerning CaP screening and treatment, the results of this self-care program are promising and warrant further exploration to delineate significant components.

References

1. Rowland JH, Aziz NM, Tesauro G, Feuer E. The changing face of cancer survivorship. *Seminars in Oncology Nursing*. 2001; 17:236–240. [PubMed: 11764706]
2. Force USPST. Screening for Prostate Cancer: U.S Preventive Services Task Force Recommendation Statement. *Annals of Internal Medicine*. 2008; 149:185–191. [PubMed: 18678845]
3. Heidenreich A, Aus G, Bolla M, Joniau S, Matveev VB, Schmid HP, Zattoni F. EAU Guidelines on Prostate Cancer. *European Urology*. 2008; 53:68–80. [PubMed: 17920184]
4. Dall'Era MA, Konety BR, Cowan JE, Shinohara K, Stauf F, Cooperberg MR, Meng MV, Kane CJ, Perez N, Master VA, Carroll PR. Active surveillance for the management of prostate cancer in a contemporary cohort. *Cancer*. 2008; 112:2664–2670. [PubMed: 18433013]
5. Wilt TJ, MacDonald R, Rutks I, Shamliyan TA, Taylor BC, Kane RL. Systematic Review: Comparative Effectiveness and Harms of Treatments for Clinically Localized Prostate Cancer. *Annals of Internal Medicine*. 2008; 148:435–448. [PubMed: 18252677]
6. Pollak MN, Foulkes WD. Challenges to cancer control by screening. *Nat Rev Cancer*. 2003; 3:297–303. [PubMed: 12671668]
7. Chan JM, Gann PH, Giovannucci E. Role of diet in prostate cancer development and progression. *Journal of Clinical Oncology*. 2005; 23:8152–8160. [PubMed: 16278466]
8. Nelson WG, DeWeese TL, DeMarzo AM. The diet, prostate inflammation, and the development of prostate cancer. *Cancer Metastasis Reviews*. 2002; 21:3–16. [PubMed: 12400993]
9. Lewis JE, Soler-Vilá H, Clark PE, Kresty LA, Allen GO, Hu JJ. Intake of plant foods and associated nutrients in prostate cancer risk. *Nutrition and cancer*. 2009; 61:216–224. [PubMed: 19235037]
10. deVere White RW, Hackman RM, Soares SE, Beckett LA, Sun B. Effects of a mushroom mycelium extract on the treatment of prostate cancer. *Urology*. 2002; 60:640–4. [PubMed: 12385925]
11. Hebert J, Hurley T, Olendzki B, Teas J, Ma Y, Hampl J. Nutritional and socioeconomic factors in relation to prostate cancer mortality: A cross-national study. *J Natl Cancer Inst*. 1998; 90:1637–1647. [PubMed: 9811313]
12. Clinton S, Giovannucci E. Diet nutrition and prostate cancer. *Annu Rev Nutr*. 1998; 18:413–440. [PubMed: 9706231]
13. Lee MM, Gomez SL, Chang JS, Wey M, Wang RT, Hsing AW. Soy and isoflavone consumption in relation to prostate cancer risk in China. *Cancer Epidemiology, Biomarkers & Prevention*. 2003; 12:665–8.
14. Giovannucci E, Rimm EB, Liu Y, Stampfer MJ, Willett WC. A prospective study of tomato products, lycopene, and prostate cancer risk. *Journal of the National Cancer Institute*. 2002; 94:391–8. [PubMed: 11880478]
15. Jian L, Du C-J, Lee AH, Binns CW. Do dietary lycopene and other carotenoids protect against prostate cancer? *International Journal of Cancer*. 2005; 113:1010–1014.
16. Willis MS, Wians FH. The role of nutrition in preventing prostate cancer: a review of the proposed mechanism of action of various dietary substances. *Clinica Chimica Acta*. 2003; 330:57–83.
17. Demark-Wahnefried W, Price DT, Polascik TJ, Robertson CN, Anderson EE, Paulson DF, Walther PJ, Gannon M, Vollmer RT. Pilot study of dietary fat restriction and flaxseed supplementation in men with prostate cancer before surgery: exploring the effects on hormonal levels, prostate-specific antigen, and histopathologic features. *Urology*. 2001; 58:47–52. [PubMed: 11445478]

18. Demark-Wahnefried W, Robertson CN, Walther PJ, Polascik TJ, Paulson DF, Vollmer RT. Pilot study to explore effects of low-fat, flaxseed-supplemented diet on proliferation of benign prostatic epithelium and prostate-specific antigen. *Urology*. 2004; 63:900–4. [PubMed: 15134976]
19. Strom SS, Yamamura Y, Forman MR, Pettaway CA, Barrera SL, Digiovanni J. Saturated fat intake predicts biochemical failure after prostatectomy. *International Journal of Cancer*. 2008
20. Fradet V, Cheng I, Casey G, Witte JS. Dietary omega-3 fatty acids, cyclooxygenase-2 genetic variation, and aggressive prostate cancer risk. *Clin Cancer Res*. 2009; 15:2559–66. [PubMed: 19318492]
21. Blanchard C, Stein K, Baker F, Dent M, Denniston M, Courneya K, Nehl E. Association between current lifestyle behaviors and health-related quality of life in breast, colorectal and prostate cancer survivors. *Psychology and Health*. 2004; 19:1–13.
22. Patterson RE, Neuhouser ML, Hedderson MM, Schwartz SM, Standish LJ, Bowen DJ. Changes in diet, physical activity, and supplement use among adults diagnosed with cancer. *Journal of the American Dietetic Association*. 2003; 103:323–328. [PubMed: 12616253]
23. Demark-Wahnefried W, Aziz NM, Rowland JH, Pinto BM. Riding the Crest of the Teachable Moment: Promoting Long-Term Health After the Diagnosis of Cancer. *Journal of Clinical Oncology*. 2005; 23:5814. [PubMed: 16043830]
24. Grandgenett RS. Watching the Trends Helps Focus Nutrition Education Strategies. *Journal of the American Dietetic Association*. 1998; 98:1000–1000.
25. Ornish D, Weidner G, Fair WR, Marlin R, Pettengill EB, Raisin CJ, Dunn-Emke S, Crutchfield L, Jacobs FN, Barnard RJ. Intensive lifestyle changes may affect the progression of prostate cancer. *Journal of Urology*. 2005; 174:1065–1070.
26. Link LB, Thompson SM, Bosland MC, Lumey LH. Adherence to a low-fat diet in men with prostate cancer. *Urology*. 2004; 64:970–975. [PubMed: 15533488]
27. Maskarinec G, Morimoto Y, Hebshi S, Sharma S, Franke AA, Stanczyk FZ. Serum prostate-specific antigen but not testosterone levels decrease in a randomized soy intervention among men. *Eur J Clin Nutr*. 2006; 60:1423–1429. [PubMed: 16775579]
28. Spentzos D, Mantzoros C, Regan MM, Morrissey ME, Duggan S, Flickner-Garvey S, McCormick H, DeWolf W, Balk S, Bubley GJ. Minimal effect of a low-fat/high soy diet for asymptomatic, hormonally naive prostate cancer patients. *Clinical Cancer Research*. 2003; 9:3282–7. [PubMed: 12960113]
29. Demark-Wahnefried W, Price D, Polascik T, Robertson C, Anderson E, Paulson D, Walther P, Gannon M, Vollmer R. Pilot study of dietary fat restriction and flaxseed supplementation in men with prostate cancer before surgery: exploring the effects on hormonal levels, prostate-specific antigen, and histopathological features. *Urology*. 2001; 58:47–52. [PubMed: 11445478]
30. Dalais FS, Meliala A, Wattanapenpaiboon N, Frydenberg M, Suter DAI, Thomson WK, Wahlqvist ML. Effects of a diet rich in phytoestrogens on prostate-specific antigen and sex hormones in men diagnosed with prostate cancer. *Urology*. 2004; 64:510–515. [PubMed: 15351581]
31. Li Z, Aronson WJ, Arteaga JR, Hong K, Thames G, Henning SM, Liu W, Elashoff R, Ashley JM, Heber D. Feasibility of a low-fat/high-fiber diet intervention with soy supplementation in prostate cancer patients after prostatectomy. *Eur J Clin Nutr*. 2007; 62:526–536. [PubMed: 17392697]
32. Saxe GA, Hebert JR, Carmody JF, Kabat-Zinn J, Rosenzweig PH, Jarzobski D, Reed GW, Blute RD. Can diet in conjunction with stress reduction affect the rate of increase in prostate specific antigen after biochemical recurrence of prostate cancer? *Journal of Urology*. 2001; 166:2202–7. [PubMed: 11696736]
33. Miller J, Fletcher K, Kabat-Zinn J. Three-year follow-up and clinical implications of a mindfulness-based stress reduction intervention in the treatment of anxiety disorders. *Gen Hosp Psychiatry*. 1995; 17:192–200. [PubMed: 7649463]
34. Grossman P, Niemann L, Schmidt S, Walach H. Mindfulness-based stress reduction and health benefits: A meta-analysis. *Journal of Psychosomatic Research*. 2004; 57:35–43. [PubMed: 15256293]
35. Carmody J, Baer RA. Relationships between mindfulness practice and Levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *Journal of Behavioral Medicine*. 2008; 31:23–33. [PubMed: 17899351]

36. Kristeller, JL.; Baer, RA.; Quillian-Wolever, R. Mindfulness-Based approaches to eating disorders. In: Baer, RA., editor. *Mindfulness and acceptance-based interventions: Conceptualization, application, and empirical support*. San Diego, CA: Elsevier; 2006.
37. Kennedy ET, Ohls J, Carlson S, Fleming K. The Healthy Eating Index Design and Applications. *Journal of the American Dietetic Association*. 1995; 95:1103–1108. [PubMed: 7560680]
38. McCullough ML, Feskanich D, Stampfer MJ, Giovannucci EL, Rimm EB, Hu FB, Spiegelman D, Hunter DJ, Colditz GA, Willett WC. Diet quality and major chronic disease risk in men and women: moving toward improved dietary guidance. *American Journal of Clinical Nutrition*. 2002; 76:1261–1271. [PubMed: 12450892]
39. Kapiszewska M. A vegetable to meat consumption ratio as a relevant factor determining cancer preventive diet. *The Mediterranean versus other European countries Forums in Nutrition*. 2006; 59:130–53.
40. Chan JM, Holick CN, Leitzmann MF, Rimm EB, Willett WC, Stampfer MJ, Giovannucci EL. Diet After Diagnosis and the Risk of Prostate Cancer Progression, Recurrence, and Death (United States). *Cancer Causes and Control*. 2006; 17:199–208. [PubMed: 16425098]
41. Meyer F, Bairati I, Shadmani R, Fradet Y, Moore L. Dietary fat and prostate cancer survival. *Cancer Causes and Control*. 1999; 10:245–251. [PubMed: 10482482]
42. Saxe GA, Major JM, Nguyen JY, Freeman KM, Downs TM, Salem CE. Potential Attenuation of Disease Progression in Recurrent Prostate Cancer With Plant-Based Diet and Stress Reduction. *Integrated Cancer Therapies*. 2006; 5:206–213.
43. Tymchuk CN, Barnard RJ, Ngo TH, Aronson WJ. Role of testosterone, estradiol, and insulin in diet- and exercise-induced reductions in serum-stimulated prostate cancer cell growth in vitro. *Nutrition & Cancer*. 2002; 42:112–6. [PubMed: 12235642]
44. Kabat-Zinn, J. *Full catastrophe living: using the wisdom of your body and mind to face stress, pain and illness*. New York: Delacorte; 1990.
45. Carmody J, Olendzki B, Reed G, Andersen V, Rosenzweig P. A dietary intervention for recurrent prostate cancer after definitive primary treatment: Results of a randomized pilot trial. *Urology*. 2008; 72:1324–1328. [PubMed: 18400281]
46. Nutrient Data System for Research (NDS-R) software. 4.03. Minneapolis, MN: Nutrition Coordinating Center, University of Minnesota; 2000.
47. Ma Y, Olendzki B, Pagoto S, Hurley T, Magner R, Ockene I, Schneider K, Merriam P, Hébert J. Number of 24-Hour Diet Recalls Needed to Estimate Energy Intake. *Annals of Epidemiology*. 2009; 19(8):553–9. [PubMed: 19576535]
48. Figueiredo JC, Grau MV, Haile RW, Sandler RS, Summers RW, Bresalier RS, Burke CA, McKeown-Eyssen GE, Baron JA. Folic acid and risk of prostate cancer: results from a randomized clinical trial. *Journal of the National Cancer Institute*. 2009; 101:432–435. [PubMed: 19276452]
49. Tymchuk CN, Barnard RJ, Heber D, Aronson WJ. Evidence of an inhibitory effect of diet and exercise on prostate cancer cell growth. *Journal of Urology*. 2001; 166:1185–9. [PubMed: 11490320]
50. Aronson WJ, Barnard RJ, Freedland SJ, Henning S, Elashoff D, Jardack PM, Cohen P, Heber D, Kobayashi N. Growth inhibitory effect of low fat diet on prostate cancer cells: results of a prospective, randomized dietary intervention trial in men with prostate cancer. *The Journal of urology*. 2010; 183:345–350. [PubMed: 19914662]
51. Shike M, Latkany L, Riedel E, Fleisher M, Schatzkin A, Lanza E, Corle D, Begg CB. 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. [see comment]. *Journal of Clinical Oncology*. 2002; 20:3592–8. [PubMed: 12202659]
52. Lillis J, Hayes SC, Bunting K, Masuda A. Teaching acceptance and mindfulness to improve the lives of the obese: A preliminary test of a theoretical model. *Annals of Behavioral Medicine*. 2009; 37:58–69. [PubMed: 19252962]
53. Albertsen PC, Hanley JA, Fine J. 20-Year Outcomes Following Conservative Management of Clinically Localized Prostate Cancer. 2005:2095–2101.

54. Post P, Kil P, Hendriks A, Janssen-Heijnen M, Crommelin M, Coebergh J. Comorbidity in patients with prostate cancer and its relevance to treatment choice. *BJU International*. 1999; 84:652–656. [PubMed: 10510110]
55. Newschaffer CJ, Otani K, McDonald MK, Penberthy LT. Causes of Death in Elderly Prostate Cancer Patients and in a Comparison Nonprostate Cancer Cohort. *Journal of the National Cancer Institute*. 2000; 92:613–621. [PubMed: 10772678]
56. Olendzki B, Speed C, Domino FJ. Nutritional assessment and counseling for prevention and treatment of cardiovascular disease. *American Family Physician*. 2006; 73:257–64. [PubMed: 16445271]
57. Van Horn L, McCoin M, Kris-Etherton PM, Burke F, Carson JA, Champagne CM, Karmally W, Sikand G. The evidence for dietary prevention and treatment of cardiovascular disease. *Journal of the American Dietetic Association*. 2008; 108:287–331. [PubMed: 18237578]

Table 1

Ratio of Animal:Vegetable Protein

	Group	Baseline	Post Intervention	P- Value [*]	3-Months Post- Intervention	P- Value ^{**}	P-Value (Time & Group) [#]
Total Calories	C	2089 +/- 701	2222 +/- 839	>0.05	2208 +/- 646 1915 +/- 431	>0.05	>0.05
	I	1955 +/- 474	1892 +/- 498				
Animal Protein (g/day)	C	60 +/- 27.8	60 +/- 19.8	0.002	62 +/- 28.5 28 +/- 16.3	0.039	.03
	I	48 +/- 19	28 +/- 17.1				
Vegetable Protein (g/day)	C	25 +/- 7.7	26 +/- 10.6	0.007	26 +/- 8.8 43 +/- 15.1	0.001	.0002
	I	27 +/- 8.4	39 +/- 14.8				
A:V ratio	C	2.55 +/- 1.16	2.60 +/- 1.07	0.011	3.00 +/- 2.99 0.86 +/- 0.81	0.049	0.025
	I	1.87 +/- 0.69	0.96 +/- 1.00				

C=control group; I=intervention group.

^{*} Comparison was made between control and intervention in the mean changes of the given variable from baseline to immediate post-intervention using t-test.^{**} Comparison was made between control and intervention in the mean changes of the given variable from baseline to 3 month post-intervention using t-test.[#] The interaction term of group assignment and time was tested using random effects regression models.