



Published in final edited form as:

*Prev Med.* 2007 March ; 44(3): 246–253.

## Fighting Cancer with Fitness: Dietary outcomes of a randomized, controlled lifestyle change intervention in healthy African-American women

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### Abstract

**Objectives**— This study tested the efficacy of an eight-week, culturally targeted community-based nutrition and physical activity promotion intervention, *Fight Cancer with Fitness!* (FCF).

**Methods**— A randomized, controlled trial was conducted in a black-owned commercial gym in a sample of 366 predominantly overweight or obese, healthy African-American women.

**Results**— Dietary quality as indexed by fruit and vegetable intake improved significantly in the intervention group compared to the control group at 12 months follow-up, and proportion of calories consumed as fat decreased in both groups.

**Conclusions**— This individually-targeted cancer prevention intervention produced beneficial effects on dietary quality that were sustained for at least 12 months.

### Keywords

African American; black; women; minority; aerobic endurance fitness; intervention; nutrition; diet; cancer prevention

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Précis:

This individually-targeted cancer prevention intervention produced beneficial effects on dietary quality that were sustained for at least 12 months. The trial was conducted with a sample of 366 women.

A.K. Yancey conceptualized the study. J. Leslie and W.J. McCarthy oversaw the data collection processes. W.J. McCarthy and A.K. Yancey directed the analyses. W.J. McCarthy conducted the longitudinal analyses. G. Harrison analyzed the dietary data. A.K. Yancey wrote the first draft of the manuscript and reference section. J.M. Siegel collaborated on the revision of the analyses. All authors jointly revised the manuscript.

\*This research was supported by a National Cancer Institute Research Award (R01 CA 73512).

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## INTRODUCTION

The magnitude and associated costs of an epidemic increase in obesity-related conditions in the U.S. are of mounting concern to public health and public policy. (Colditz and Mariani 2000; French, Story et al. 2001; Kersh and Morone 2002; Sturm 2002; Chou, Grossman et al. 2004; Swinburn, Gill et al. 2005) Addressing the acceleration of this epidemic is particularly important to efforts to eliminate health disparities, as obesity is a primary driver of chronic disease disparities such as cardiovascular diseases, Type 2 diabetes mellitus, and certain cancers. (Kumanyika 1987; Pi-Sunyer 1991; McGinnis and Foege 1993; Myers, Kagawa-Singer et al. 1995; Koplan and Dietz 1999; Mokdad, Serdula et al. 1999; Smith, Clark et al. 2005; Yancey, Robinson et al. 2005) African-American women have higher rates of obesity and more severe levels of obesity compared with other major ethnic-gender groups (Kuczmarski, Flegal et al. 1994; National Institutes of Health NHLBI 1998) and are at greater risk of death from obesity-related cancers such as breast cancer and colon cancer. (Jemal, Clegg et al. 2004) Both dietary and physical activity patterns contribute to this disparity, (United States. Dept. of Agriculture. and United States. Dept. of Health and Human Services. 2000) reflecting primarily excess sociocultural, physical and economic environmental risk. (Kumanyika 2002) Increasing intake of fruits and vegetables, decreasing red meat intake and decreasing fat intake, as well as increasing daily physical activity, are believed to be helpful in preventing cancer. (Byers, Nestle et al. 2002)

Unfortunately, relatively little ethnic-specific data are currently available with which to examine these trends. (McCrary, Fuss et al. 1999; Krebs-Smith and Kantor 2001; Nielsen, Siega-Riz et al. 2002; Lewis, Mayhugh et al. 2003; Schlundt, Hargreaves et al. 2003; Champagne, Bogle et al. 2004) Efforts to address these trends have also been anemic. (Kumanyika 2001; Kumanyika 2002; Yancey, Kumanyika et al. 2004) For instance, in reviewing the past several decades of scientific literature on individually-targeted weight-related lifestyle interventions targeting or including meaningful numbers of ethnic minorities, Kumanyika (Kumanyika 2002) found only 20 studies. Most of these interventions produced significant but modest changes immediately post-intervention, followed by decay of these effects during the follow-up periods. These outcomes were consistent with the findings presented in a recent consensus report on the clinical treatment of overweight and obesity, (National Institutes of Health NHLBI 1998) and with the conclusions of an NIH expert panel report, based on many more studies of predominantly white, European-American populations. (Jeffery, Drewnowski et al. 2000; Kumanyika, Van Horn et al. 2000; Marcus, Dubbert et al. 2000; Wing 2000)

The expert panels' conclusions and other studies (Rolls, Kim-Harris et al. 1994; Stubbs, Ritz et al. 1995; Bell, Castellanos et al. 1998) led the USDA/NIH Dietary Guidelines panel to encourage Americans to achieve healthier weight control especially by eating less dietary fat. (Booth, Sallis et al. 2001) These recommendations have been reinforced by such subsequent findings as a reduction in risk of diabetes by as much as 58% as a result of the weight loss and increased aerobic endurance fitness achieved by community-living adults randomly assigned to a low-fat diet and increased physical activity. (Knowler, Barrett-Connor et al. 2002) This position superseded the emphasis of earlier editions of the Guidelines on across-the-board calorie restriction. (United States. Dept. of Agriculture. and United States. Dept. of Health and Human Services. 2000) More recent lifestyle intervention studies in non-clinical samples that included a substantial proportion of African Americans include: e.g., the Diabetes Prevention Program, (Knowler, Barrett-Connor et al. 2002) Body and Soul, (Resnicow, Campbell et al. 2004) the Women's Health Trial, (Bhargava and Hays 2004) the PREMIER study, (Appel, Champagne et al. 2003) the Women's Health Initiative, (2004) and the Eat Well, Live Well Nutrition Program in the Midwest. (Auslander, Haire-Joshu et al. 2002) However, none could be identified that specifically targeted the needs of middle aged and older, healthy, obese

African-American women, a high-risk group that historically has been observed to have greater adherence challenges and poorer outcomes. (Kumanyika 2002, 2004)

The African-American Women Fight Cancer with Fitness (FCF) study tested the efficacy of a culturally-targeted nutrition and physical activity intervention. The intended cancer-protective outcomes included anthropometric, emotional and behavioral changes in African-American women. A social support component intended to influence the participants' social environments was included. The feasibility of recruiting and engaging this target population had been demonstrated in a predecessor pilot study. (Yancey, McCarthy et al. 1998) Physical fitness (aerobic endurance), physical activity level and body composition results of this study are the subject of a separate article. The intervention produced significant, but short-term improvements in BMI, and sustained improvements in depressive symptoms and one-mile run/walk treadmill times. (Yancey, McCarthy et al. 2006) Only dietary data and dietary outcomes are presented in this paper.

## METHODS

Recruitment procedures and strategies, and characteristics of the 845 women screened to generate the study sample of 366 have been described in detail elsewhere. (Yancey, Miles et al. 2001) The experimental design-related methods have also been detailed elsewhere (Yancey, McCarthy et al. 2006) and are summarized below. FCF was a randomized controlled trial, with an attention control condition. Both intervention and control groups received 8 weekly 2-hour sessions. A 1-year membership to this gym was offered as an incentive for study participation for all subjects, whether assigned to the intervention or to the control condition.

### Intervention and attention control conditions

In their 8 weekly sessions, "Fitness" intervention group participants received instruction on skills training in a balanced regular exercise regimen (muscle strengthening, flexibility enhancement and aerobic conditioning), and nutrition education promoting a low-fat, complex carbohydrate-rich diet, emphasizing the cancer-preventive benefits of increased fruit and vegetable intake. Weight loss was not a focus of the intervention. Participants in the intervention condition were also interviewed by a dietitian about their food intake in the previous 24 hours 2–3 times during the intervention, and given detailed written feedback on the quality and adequacy of their intakes. The intervention also included instruction in lifestyle integration of a broad range of physical activities. Inexpensive incentives, e.g., pedometers and exercise bands, were distributed to reinforce intervention messages.

The content of the 8 weekly sessions in the control condition consisted of interactive group sessions on current African-American women's health topics. These sessions were facilitated by project staff not involved in intervention delivery. The majority of sessions explored ethnic disparities in cancer incidence and outcomes. Emphasis was placed on barriers to and facilitators of tobacco control, and screening behaviors for breast, cervical, uterine, colorectal, prostate, and skin cancer among African Americans. Two non-cancer topics, menopause and depression, were also included.

The intervention and control conditions were delivered during 6 consecutive 3-month periods to cohorts of approximately 60 women (about ½ intervention and ½ control). Follow-up data were collected at 2 months (immediately post-intervention), 6 months, and 12 months after initiating intervention delivery.

## Subjects

Only women who self-identified as African American were eligible. Figure 1 in a predecessor publication (Yancey, McCarthy et al. 2006) describes the retention statistics, by condition, across the four assessments. Women responding to study promotion materials were screened on the telephone. Exclusion criteria included any history of invasive carcinoma (because of involuntary weight change with cancer treatment (e.g., Cheney et al., 1997), (Cheney, Mahloch et al. 1997) inability to walk one mile without assistance, current cigarette smoking, not living or working within a ten mile radius of the intervention site, inability to commit to participating in the study or follow-up assessments for two years and high level of previous use of structured weight loss programs (3 or more). If two friends wanted to enroll, we asked that one of them become a support person for the other. Support persons were given free memberships in the gym and encouraged to work out with their buddy but were not permitted to attend the instructional sessions. This was done to avoid the problem of attenuated experimental contrast if two friends were assigned to different experimental conditions and talked to each other about their experiences.

Research purpose, eligibility and procedures (including randomization) were explained at this time. A portion of the script used by project staff read, "...This is a cancer prevention study to compare two programs designed to help black women reduce their risk of cancer and improve their appearance. The first program involves eight weekly two-hour sessions on diet and exercise. The second program involves eight weekly two-hour sessions on current health topics of interest to black women, such as breast cancer and menopause. Both programs will be conducted by black women physicians and other professionals. We'll decide which group you'll be assigned to randomly, for example, by flipping a coin..." Those deemed eligible by screening questionnaire and willing to be randomized were given a schedule of study enrollment sessions at the study site and provided instructions on preparation for the assessments. The study was approved by the UCLA Human Subjects Protection Committee. All participants provided written informed consent.

The study site was the same ethnically diverse community health club that hosted the pilot. (Yancey, McCarthy et al. 1998; Siegel, Yancey et al. 2000) A membership to this gym was offered as an incentive for all study participants, with the experimental and control groups being offered alternate days to minimize cross-condition contamination. At the study site, informed consent was obtained and screening for conditions precluding moderate exercise was performed, using American College of Sports Medicine guidelines. (American College of Sports Medicine. 1991) An extensive battery of questionnaire and anthropometric data was obtained. This baseline assessment provided women with exposure to the demands of data collection before they fully committed to participate. Subjects were assigned consecutive enrollment numbers by the data entry staff member, after the screening questionnaire data were entered for that subject. Randomization to study condition was based on the enrollment number. Each enrollment number was assigned to the "Fighting Cancer with Knowledge" (Knowledge) control condition or "Fighting Cancer with Fitness" (Fitness) experimental condition using a random number-generating computer algorithm. The staff member assigning enrollment numbers was unaware of the previously determined experimental assignment and had no contact with study participants. Subjects were notified of their assignments by telephone and carefully instructed about meeting times and instructed to bring apparel that would be appropriate for exercise. Some participants had to wait more than two months before enrollment in classes because the early and unanticipated success of the recruitment strategies in generating prospective participants outstripped class capacity in which to enroll them. (American College of Sports Medicine. 1991) In some instances, lack of immediate match between the participant's availability and the availability of a class for her experimental condition delayed enrollment. Ten participants (2.7%) either lost interest or were no longer available to participate by the

time their assigned class was finally set to begin. Only those participating in at least one class session were considered to be fully enrolled study participants (n = 366).

### Intervention and attention control conditions

**Theoretical framework**—As with other American women, some of the motivation among African-American women for learning to eat differently and exercise more frequently emanates from a need to reduce the discrepancy between current and ideal body weight. (Cachelin, Rebeck et al. 2002) Images of physically fit, black women successfully engaging in lifestyle change are needed to compete with the seductive environmental assault of culturally-targeted advertising for fatty foods and disproportionate depiction of images of overweight black women. (Tirodkar and Jain 2001) In-person testimonials and video portrayals can be used to diminish the social distance between participants and positive role models. (Bandura 1986;Bandura 1996) Facilitating identification with ethnically relevant role models in culturally significant contexts was hypothesized to impart knowledge, influence attitudes, and affect self-concept, thereby increasing the motivation to engage in cancer-protective dietary and physical activity behaviors. (Becker and Maiman 1975;Fishbein and Ajzen 1975;Hallal 1982;Ramirez and McAlister 1988;Tice 1992) Both social learning theory/Social Action Theory (Bandura 1986;Bandura 1996) and a social ecological perspective (Stokols 1996) are imbedded in the FCF approach.

The evidence for the synergistic benefit of changing dietary choices and physical activity levels simultaneously (Klem, Wing et al. 1997) has become so accepted that the designers of the recently concluded Diabetes Prevention Program did not attempt to include separate conditions for exercise alone or a low-fat diet alone. (Knowler, Barrett-Connor et al. 2002) Increasingly reported in the literature is evidence that exercise can modulate taste preferences, e.g., the desirability of high satiety foods. Westerterp-Plantenga and her associates (Westerterp-Plantenga, Verwegen et al. 1997) showed in a cross-over design that undergraduate males exposed to two hours of rest ate foods higher in energy density and lower in water content than did the same undergraduates exposed to two hours of sauna or two hours of exercise cycling. Most fruits and vegetables have an energy density of less than 1 kcal per gram (United States. Dept. of Agriculture. and United States. Dept. of Health and Human Services. 2000) as a result of their high proportion of water and dietary fiber. (Grunwald, Seagle et al. 2001) When found together in foods, these two constituents have been shown to enhance satiety. (Holt, Miller et al. 1995) At the same time, exercise appears to increase preferences for beverages of lesser sweetness. (Westerterp-Plantenga, Verwegen et al. 1997;Passe, Horn et al. 2000) Progressive goal-setting is a feature long used in social learning theory to enhance self-efficacy and motivate continued striving (Bandura 1986;Bandura 1996) and has been shown to be useful in motivating dietary change. (Schnoll and Zimmerman 2001) Havas et al. (Havas, Anliker et al. 1998) noted that low-income women participating in WIC programs could be induced to eat sustainably higher numbers of daily servings of fruits and vegetables when their target numbers of servings took into account their baseline consumption of numbers of servings. Thus, physiological and psychosocial behavior change strategies were used complementarily in FCF.

**Intervention development and implementation**—The Fitness intervention was refined through pre-testing in a focus group setting, modified, and further pilot-tested in a sample of 15 women. Fitness intervention group participants received 8 weekly 90-minute interactive group sessions, including exercise instruction, usually facilitated by the project staff. Ethnically appropriate community role models served as guest instructors in both the Fitness and Knowledge conditions. The intervention consisted of skills training in a balanced regular exercise regimen (muscle strengthening, flexibility enhancement and aerobic conditioning); nutrition education promoted a low-fat, complex carbohydrate-rich (high-fiber) diet, emphasizing the cancer-preventive benefits of increased quantity and variety of fruit and

vegetable intake. (Shick, Wing et al. 1998; McCrory, Fuss et al. 1999; Lanza, Schatzkin et al. 2001) As reflected in the study title, healthy behavior change, particularly increased physical activity and fruit and vegetable consumption, not weight loss, was the focus in intervention delivery. Participants in the Fitness intervention were interviewed by a dietitian about their food intake in the previous 24 hours (24-hour dietary recall) up to four times during the 8-week intervention, and given feedback on the quality and adequacy of their intakes. The intervention also included instruction in lifestyle integration of a broad range of physical activities. In order to provide and study the role of social support, each intervention participant was encouraged to invite one close female relative or friend to accompany her during post-intervention use of health club facilities (the friend also received a free gym membership). These social contacts were not included as study subjects. Table 1 in Yancey et al. (Yancey, McCarthy et al. 2006) provides an overview of the curriculum for the Fitness intervention. To summarize this table, the 8 nutrition-specific lessons included: 1) nutrition fundamentals, 2) potentially synergistic impact of combining increased physical activity with healthier food choices, 3) benefits of substituting whole grain plant foods for refined foods and replacing high-fat animal foods with soybean-based foods, 4) strategies for shopping healthfully, 5) how to cook low-fat, high-fiber meals, 6) eating low-fat, high-fiber meals when dining out, 7) establishing eating habits that reduce risk of overeating, and 8) avoiding the yo-yo diet fad syndrome in favor of gradually more healthful lifestyle pattern of eating.

Subjects assigned to the Knowledge condition received 8 weekly, 90-minute interactive group sessions on current African-American women's health topics without the external social support component. These sessions were facilitated by project staff not involved in intervention (Fitness condition) delivery. The majority of sessions explored ethnic disparities in cancer incidence and outcomes. Emphasis was placed on barriers to and facilitators of tobacco control, and screening behaviors for breast, cervical, uterine, colorectal, prostate, and skin cancer among African Americans. Two non-cancer topics, menopause and depression, also were included. These topics were selected by vote of participants during the first session. Guest role models for the control group were recruited among cancer survivor support groups and black physicians' organizations. The series of nationally distributed breast, cervical, and prostate cancer prevention videos developed in the UCLA Division of Cancer Prevention and Control Research were featured in the Knowledge control condition sessions. (Yancey and Walden 1994; Yancey, Tanjasiri et al. 1995)

## Measures

Food frequency dietary data were collected at baseline and at the 12-month follow-up only. Sociodemographic data were collected only at baseline. All other measures were collected at baseline, 2 months (immediately post-intervention), six months and 12 months. The assessment staff was independent of the intervention staff, and blind to the experimental assignment of each participant. Follow-up assessments were conducted at individual appointments in the same commercial gym where the intervention classes were held. To maximize study retention, participants in both groups were paid \$50 per follow-up assessment. No payment was provided for participating in the baseline assessment, in order to minimize participation that was motivated primarily by the financial incentives.

**Diet**—The National Cancer Institute Health Habits and History Questionnaire (Block Food Frequency instrument –NCI version 02.1) (National Cancer Institute (U.S.), Information Management Services. et al. 1994) was administered at baseline and at the 12-month follow-up only. This instrument has been widely used to assess usual diet over the previous one-year period in American adults.

## Data analysis

Dietary data were analyzed using the DietSys program (National Cancer Institute) developed specifically for the Block food frequency instrument; estimated intake of selected nutrients were compared between groups at baseline and 12 months with paired “t” tests. There was considerable missing data, including 21 baseline food frequency questionnaires that were accidentally thrown out before data entry, and we additionally excluded records that yielded <500 kcal/day or >4500 kcal/day from analysis. Analyses of dietary data were carried out on the remainder, namely 100 subjects in the intervention group and 101 in the control group.

Similarity of baseline demographic statistics between the two groups confirmed that randomization apparently worked. Baseline measures for the outcome variables weight and BMI also did not differ between the two experimental groups.

## RESULTS

Following the practice of other community-based lifestyle intervention trials, only those participating in at least one class session were included in the analyses. (Danielsson, Rossner et al. 1999) Of 192 women tentatively assigned by randomization to the control condition, 14 (7.3%) failed to attend a single class and therefore were considered never to have participated in the study; of 197 women tentatively assigned by randomization to the intervention condition, 9 (4.6%) failed to attend a single class and therefore were considered never to have participated in the study. This difference was not statistically significant, i.e. there was no differential attrition between groups prior to full study enrollment. Of the resulting study sample, 188 were assigned to the Fitness (intervention) condition and 178 to the Knowledge (control) condition. The proportion of classes attended was associated with experimental condition (control mean = 87% of classes; intervention = 80% of classes;  $t(364) = 3.33, p < .001$ ). More than 70% of study participants were retained in the study at 12 months follow-up.

Baseline characteristics of the study participants are presented in Table 1. On average, the women were in their mid-forties, had completed three years of college, earned moderate incomes, and were obese. Subjects with food frequency record data retained for analysis ( $n = 196$  "analysis stayins") were compared to subjects whose food frequency record data were either missing or unusable ( $n = 174$  "analysis dropouts"), to evaluate whether the "analysis stayins" differed systematically from "analysis dropouts." Comprehensive comparative analyses of baseline data comparing the "analysis stayins" with the "analysis dropouts" revealed no systematic differences between groups. On only 5 of 32 variables examined were the "analysis stayins" different from the "analysis dropouts," and those differences were not large, practically speaking. The "analysis stayins" were slightly older (age = 46.6 vs 42.4 years), had slightly smaller families (2.3 vs 2.5 persons sharing home), self-reported slightly less weight at age 20 years (56.8 vs 59.6 kg), reported slightly less household support for lifestyle change (4.4 vs 4.8) and reported slightly higher self-esteem (3.3 vs 3.1) (all comparisons,  $p < .03$ ). Both the "analysis stayins" and the "analysis dropouts" were relatively evenly divided between the intervention and control groups, respectively ("stayins" = 101 vs. 95, "dropouts" = 87 vs. 83).

## Diet

Table 2 shows estimated daily intakes for selected nutrients and food components for the intervention and control groups at baseline and at 12-month follow-up, calculated from the food frequency questionnaire. Energy intakes are expressed as a multiple of basal metabolic rate (BMR), estimated from anthropometry. (WHO Expert Committee on Physical Status: the Use and Interpretation of Anthropometry. 1995) Baseline reported energy intakes are 15–20% lower than one would expect for women leading relatively sedentary lives, as expected and

consistent with data from US women in many surveys. These levels are likely due to systematic under-reporting of food intake; (Schoeller 1995) there is no reason to believe that the two treatment groups would differ in their tendency to underreport food intake. There was no difference between control and intervention subjects at baseline; at the 12-month follow-up control subjects had significantly decreased their reported energy intake ( $p < .01$ ) while the intervention subjects had maintained their level of reported intake without change. Both groups of women decreased their fat and saturated fat intakes, as a percent of dietary energy intake, modestly during the year.

Dietary fiber and carotenoid intake are of particular interest because whole grain cereal products and fruit and vegetable intake were specific foci of the intervention curriculum. The intervention group increased dietary fiber intake from an average of 14.4 g/day to 16.1 g/day, an increase that was statistically significant and resulted in significant differences between groups at follow-up. The control group showed no significant change in dietary fiber intake. Carotenoid intake increased in both groups, but more in the intervention group.

Table 3 shows average weekly intake (servings) of various food groups at baseline and 12 months follow-up for intervention and control group subjects, again calculated from the food frequency questionnaire (no measures of dispersion are calculated by the DietSys software). Average fruit, juice and vegetable intake all increased substantially for intervention subjects but not for control subjects. Whole grain cereals and breads, dairy products, meat, chicken and fish/seafood, and fried foods showed no differences between groups at baseline or follow-up. Thus, it appears that the improvement in dietary quality indicated in Table 2 is entirely due to increased consumption of both fruits and vegetables among intervention group subjects. Intervention group subjects increased fruit consumption by two servings/week and vegetable consumption by more than six servings/week; total fruit and vegetable intake increased by 9.5 servings/week.

## DISCUSSION

Many FCF participants had weight loss as an intended goal of participation; however, weight loss was not the focus of the intervention as was noted earlier. Rather, the overall health benefits of increasing physical activity and aerobic endurance fitness, and of a health-promoting diet, were emphasized. Specifically, the cancer-protective effects of eating fruits and vegetables were a major focus. The 1.4 daily F+V serving increase observed in the FCF results compares favorably with the 0.7–1.4 F+V serving increases observed in the church-based Body and Soul intervention, (Resnicow, Campbell et al. 2004) with the 1.0–1.4 F+V serving increases in the Eat for Life intervention (Resnicow, Jackson et al. 2001) and with those in the Women's Health Trial Feasibility Study in Minority Populations. (Bhargava and Hays 2004) The 3% decrease in calories from fat compared with baseline is also similar to the 4% reduction observed among the younger, but heavier and lower socioeconomic status African-American women in the Eat Well, Live Well Nutrition Program in the Midwest, (Auslander, Haire-Joshu et al. 2002) though the FCF participants baseline levels were somewhat higher (38% vs. 36%). Actually, the nearly identical saturated (11–13%) and total dietary fat intakes reported for both of these similarly sized (394 vs. 364), but sociodemographically different (region of residence as well as age, SES and severity of obesity) samples of African-American women are striking. The fact that the Fitness condition women did not decrease their dietary energy intakes, but measurably improved the nutritional quality of their diets, is consistent with the content of the intervention curriculum. The decrease in energy intake by the control group women, together with the general lack of improvement in aspects of dietary quality other than fat intake, probably reflects their attempts to implement what they already knew—that lower fat intakes would be desirable. Dietary fat restriction would also have been a likely message from health club staff who they may have consulted during their gym-based exercise participation.



Several study limitations should be noted. The large proportion of participants for whom dietary data were missing or were unusable is of concern, despite the lack of statistically significant differences between those with complete and incomplete dietary information. The socioeconomic status of the study sample is substantially higher than that of black women in general, limiting generalizability (while permitting greater comparability with white study samples). In addition, the secular increases in obesity, particularly in this population, (Truong and Sturm 2005) may adversely affect even the most effective of dietary change interventions in the current climate. The lack of dietary assessment data at 2 months and 6 months prevented a more detailed description of when dietary changes "peaked" and the shape of the curve reflecting regression over time to baseline dietary practices. Such near-term and medium-term dietary change information could shed additional light on the natural history of dietary change following intensive exposure to dietary education.

Because neither FCF nor many of the other recently conducted individually-targeted dietary/physical activity lifestyle interventions have produced sustainable improvements in body weight, more "upstream" systemic or community-level environmental change approaches must receive greater research and policy attention if this nation is to substantively influence the course of the obesity epidemic and effectively address obesity-related ethnic health disparities. (Koplan and Dietz 1999; French, Story et al. 2001; Kumanyika 2001; Kersh and Morone 2002; Yancey, Kumanyika et al. 2004; Yancey, Robinson et al. 2005)

#### Acknowledgements

The authors are grateful to Dr. Roshan Bastani, Alex Ellis, Dr. Patricia Ganz, Jamie Hill, Michael Jackson and Gerard Short of Jack's Fitness and Training Center, Carolyn Jones, Octavia Miles, Danielle Osby, Anthony Ramirez, Dr. Carolyn Rowley, Genaro Sandoval, Dr. Anne Staveren, Evelyn Tucker, and Mildred Wilson for their contributions to the conduct of this research or writing of this manuscript. This research was supported by a National Cancer Institute Research Award (R01-CA73512) and a NCI Research Supplement for Underrepresented Minority Graduate Assistants (R01-CA73512-03).

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Table 1

Descriptive statistics for fully enrolled study participants at baseline

	Knowledge (control) condition				Fitness (intervention) condition					
	N	Minimum	Maximum	Mean	Std. Deviation	N	Minimum	Maximum	Mean	Std. Deviation
Age at baseline (years)	165	23	77	46.52	10.10	183	21	73	44.56	10.82
Household income*	169	1	6	3.02	1.31	184	1	6	3.09	1.39
How many years of education have you had? (20 years max)**	173	10	20	14.98	2.16	186	12	20	15.06	2.24
Height in meters at baseline	178	1.50	1.91	1.66	0.07	188	1.47	1.93	1.66	0.07
BMI (kg/m <sup>2</sup> ) at baseline	175	17.58	48.43	30.81	6.51	187	19.26	50.48	29.72	6.36
Weight in kg at baseline	175	40.86	148.91	85.0	19.24	187	51.30	149.82	82.07	18.78
Maximum lifetime weight (kg)	172	45.85	167.07	87.07	20.86	183	52.21	148.00	85.57	19.13
Average systolic blood pressure at baseline	173	94	170	124.10	15.10	182	90	180	121.76	17.65
Average diastolic blood pressure at baseline	173	40.5	100	73.95	9.40	181	38.5	102	73.90	10.79

\* Household income included the following categories: 1) under \$20,000, 2) \$20k – \$39k, 3) \$40k – \$59k, 4) \$60k – \$79k, 5) \$80k – \$99k, 6) \$100k+

\*\* With respect to educational attainment, 12 = high school, 16 = B.A., 18 = M.A., 19 = J.D., 20 = Ph.D. or MD. 2) \$20k – \$39k, 3) \$40k – \$59k, 4) \$60k – \$79k, 5) \$80k – \$99k, 6) \$100k+ \*\* With respect to educational attainment, 12 = high school, 16 = B.A., 18 = M.A., 19 = J.D., 20 = Ph.D. or MD.

Reduced Ns due to random missing data

**Table 2**  
Baseline and Followup (12 months) Nutrient Intakes for Intervention and Control Subjects (mean  $\pm$  sd)

	Baseline		Follow-Up	
	Control	Intervention	Control	Intervention
Energy (multiple of estimated BMR) <sup>1</sup>	1.19 $\pm$ .56	1.14 $\pm$ .49	.97 $\pm$ .41**	1.19 $\pm$ .56
Percent Energy from Fat	38.2 $\pm$ 8.6	38.4 $\pm$ 8.4	36.8 $\pm$ 8.9**	35.2 $\pm$ 8.7**
Percent Energy from Saturated fat	12.7 $\pm$ 3.3	13.0 $\pm$ 3.2	12.2 $\pm$ 3.2*	11.7 $\pm$ 3.4**
Dietary fiber (g)	15.0 $\pm$ 7.9	14.4 $\pm$ 6.8	14.1 $\pm$ 6.6 <sup>#</sup>	16.1 $\pm$ 7.3,** <sup>#</sup>
Carotenoids (ug) <sup>2</sup>	10643 $\pm$ 8146	10703 $\pm$ 9094	11355 $\pm$ 779, <sup>#</sup>	13140 $\pm$ 1217, <sup>**#</sup>

<sup>1</sup> Energy intake expressed as kcal/BMR, with BMR estimated from anthropometry (height and weight), age and activity (light activity) by FAO/WHO methodology. (WHO Expert Committee on Physical Status: the Use and Interpretation of Anthropometry. 1995)

<sup>2</sup> alpha-carotene + beta-carotene + lutein + zeaxanthin

Note: intakes of folate, calcium, zinc, iron, and protein not shown; no differences between baseline and follow-up or between groups.

\* p<.05, baseline compared to follow-up

\*\* p<.01, baseline compared to follow-up

<sup>#</sup> p<.05, control compared to intervention group

**Table 3**  
Reported Weekly Frequency of Consumption of Selected Food Groups at Baseline and 12-Month Follow-up for Intervention and Control Group Subjects (mean)

	Baseline		Follow-Up	
	Control	Intervention	Control	Intervention
Fruits	8.71	10.25	8.77	12.45
Juices	7.64	6.68	7.74	9.0
Vegetables (total)	20.83	19.76	22.24	27.01
Vegetables excluding Potatoes, beans, French fries, chips	16.06	16.09	18.73	22.83
Total fruits and Vegetables	29.54	30.01	31.01	39.46
Whole grain Breads & cereals	6.64	8.33	7.18	8.20
Dairy	19.02	17.73	17.38	17.33
Meats	4.16	3.82	3.44	3.41
Chicken	3.63	3.74	3.37	3.69
Fish & seafood	2.58	2.43	2.67	2.68
Fried food- chicken, Fish, etc.	2.92	2.42	2.22	2.29