A Controlled Evaluation of Staging Dietary Patterns to Reduce the Risk of Diabetes in African-American Women

WENDY AUSLANDER, PHD[1]
DEBRA HAIRE-JOSHU, PHD[2]
CHERYL HOUSTON, PHD, RD[3]
CHAIE-WON RHEE, MSW[1]
JAMES HERBERT WILLIAMS, PHD[1]

OBJECTIVE — This study evaluated the 3-month follow-up data of the Eat Well, Live Well Nutrition Program, a culturally specific, peer-led dietary change program designed to reduce the risk of type 2 diabetes in low-income African-American women. This peer-led program was delivered in the community and was tailored to the participants' stage of change for individual dietary patterns. We report the results of the 3-month intervention and the extent to which dietary changes and other key outcomes were maintained at a 3-month follow-up assessment.

RESEARCH DESIGN AND METHODS — Using an experimental control group design, 294 overweight African-American women (ages 25–55 years), recruited in collaboration with a neighborhood organization, completed pre- and posttest and 3-month follow-up interviews of dietary behaviors, knowledge, attitudes, fat intake, and weight.

RESULTS — Significant reductions were found in fat intake among women in the treatment condition when compared with women in the control group; these reductions were maintained at 3-month follow-up assessment. Likewise, significant changes in dietary patterns were reported after the study and were maintained, except for one dietary pattern (replacement).

CONCLUSIONS — This model of health promotion, which individually tailors dietary patterns through staging and use of peer educators, has the potential for decreasing fat intake and increasing and maintaining specific low-fat dietary patterns among overweight African-American women at risk for diabetes.

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The prevention of type 2 diabetes among African-American women is critical because of the high rates of diabetes-related mortality and morbidity in this population. Among African-American women, diabetes is considered epidemic; the rate is 11.8% among women ≥ 20 years of age, and 25% among women >55 years of age. This is nearly twice the rate of Caucasian women (1). In addition, African-Americans experience higher rates of diabetes-related complications than Caucasians, such as eye disease, kidney failure, and lower extremity amputations. For example, the frequency of diabetic retinopathy is 40–50% higher, and end-stage renal disease is four times more likely among African-Americans than Caucasians. Moreover, the overall mortality rate among African-American women is 40% higher compared with their Caucasian counterparts (2).

One explanation for the higher rates of diabetes in this population is the higher amount of dietary fat consumed by African-Americans when compared with Caucasians (3,4). Dietary patterns have been examined as a major risk factor contributing to type 2 diabetes. For example, in their description of the lifestyle risk factors for type 2 diabetes, Rewers and Hamman (5) indicated that higher dietary fat intake was associated with a higher risk of diabetes, even after adjusting for obesity, age, sex, ethnicity, fat distribution, and fasting insulin levels. Moreover, recent nutrition-related recommendations for diabetes prevention have indicated that reducing intake of total and saturated fat, independent of total calories, may reduce the risk of diabetes (6). This result may be explained by the adverse impact that dietary fat has on insulin sensitivity (6). Thus, changing dietary patterns to reduce fat intake may be important for reducing the risk of diabetes.

To address this challenge, a community-based dietary change program, the Eat Well, Live Well Nutrition Program (EWLW), was delivered to African-American women at risk for diabetes. Its primary focus was to reduce dietary fat intake and increase low-fat dietary patterns by tailoring the intervention to participants' readiness to make changes in their diet. Although weight reduction was encouraged, healthy eating through lowering fat in the diet was the major emphasis for recruitment and program content.

Few dietary change programs use participants' readiness to change as a method for individually tailoring program content. The stages of change theory, which guided the delivery of the EWLW program, asserts that change is a dynamic process occurring over these distinct stages (7): *1*) precontemplation, the stage at which the person is unaware of the risk of their behavior or aware but unwilling to consider changing a given behavior in the foreseeable future; *2*) contemplation, the stage that begins when the individual is thinking about changing a behavior, but is not taking active steps to

From the [1]George Warren Brown School of Social Work, Washington University, St. Louis, Missouri; [2]School of Public Health, St. Louis University, St. Louis, Missouri; and [3]Fontbonne College, St. Louis, Missouri.

Address correspondence and reprint requests to Wendy Auslander, PhD, George Warren Brown School of Social Work, Washington University, Campus Box 1196, St. Louis, MO 63130. E-mail: wendyaus@gwbmail.wustl.edu.

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Abbreviations: EWLW, Eat Well, Live Well Nutrition Program; FFQ, food frequency questionnaire.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

change; 3) preparation, the stage during which the individual is making definite plans to change a given behavior; 4) action, the stage during which the individual initiates the behavior change by actively modifying habits or environment; and 5) maintenance, the stage during which the individual is sustaining the behavior change and preventing relapse. Individuals may cycle through the stages several times before they maintain a change in behavior (8). This theory has been used to assess and guide intervention programs for a variety of health behaviors, such as smoking cessation (9), exercise (10), and weight control (11). Although recently this theory has been used in cross-sectional studies to predict dietary fat intake among African-American women (12), only a few studies, such as the one by Greene and Rossi (13), have used this theory for intervention in dietary change, and none has staged specific dietary patterns in an attempt to tailor program content among African-American women.

The purpose of this study was to evaluate the extent to which African-American women who participated in the EWLW reduced and maintained lower dietary fat intake in a 3-month follow-up period.

RESEARCH DESIGN AND METHODS

Procedures

Participants in the EWLW were recruited individually through a social service agency that served as the program's sponsor and through advertisements in neighborhood newspapers that targeted African-American audiences. African-American women ages 25–55 years and living in the neighborhoods were eligible for the study if they did not have diabetes, were not pregnant, and were >20% over ideal body weight, as determined by self-report (BMI >27). Eligible subjects were randomly assigned to a treatment or control group. Baseline data were collected before the intervention, at posttest intervals (immediately after the 3-month program), and at a 3-month follow-up assessment. The total study time period was 6 months. There was no further intervention during the posttreatment period for the treatment group. Participants in the control group did not receive any intervention during the treatment or follow-up phases, but were given a self-help workbook that reflected the content of the program and were offered a half-day workshop on healthy, low-fat eating after their follow-up assessment.

Description of program, integrity, and peer educator training

The EWLW was developed as a result of the collaborative partnership of health professionals affiliated with Washington University and peer educators from the Wellness Initiative of the sponsoring agency. Peer educators, who were African-American women from the target community with no background in nutrition or education, were recruited by the lead agency to deliver the intervention. The peer educators were trained by a team consisting of dietitians, social workers, and health educators over a 4-month period (~3 half-days per week). A more detailed description of the training and peer-led, community approach is described elsewhere (14–16).

The manual-based program consisted of six group sessions (approximately six to eight participants per group) and six individual sessions with a peer educator, integrated over the 3-month intervention phase. Participants met weekly with the peer educator. Each individual session focused on a dietary pattern that represented a way to reduce fat in the diet, including "avoid fat as seasoning," "substitution" of specially manufactured foods for higher fat counterparts, "modify meat" or removing fat and skin from meat, "avoid fried foods," and "replacement" or replacing high-fat foods with fruits, vegetables, grains, and bread. During the individual sessions, the peer educator assessed each participant's stage or readiness to change each of the five dietary patterns, and then tailored the session content to that stage.

The content of the six group sessions focused on specific skill areas that included the following: *1*) "rate your plate" (participants learned how to assess the fat in their diet and target areas for change, *2*) label reading (emphasizing portion size and the total fat and saturated fat content of food), *3*) comparison shopping (emphasizing skills to purchase low-fat foods on a budget), *4*) recipe modification (keeping culturally rich recipes in the diet while reducing fat content), *5*) eating out (making healthy food choices in fast food and other restaurants), and *6*) coping with high-risk situations.

To assess program integrity, sessions were randomly audiotaped and scored by independent raters using detailed session checklists. Results of the process evaluation indicated that the peer educators delivered 91.42% of the content across 12 sessions and that the overall accuracy of information delivered was 88.52% (averaged across the three peer educators). The EWLW process evaluation methods and results are discussed in more detail elsewhere (16).

Variables

Evaluation of the effectiveness of the intervention was performed on data from before and after treatment and from follow-up assessments on the following behavioral and physical outcome variables. In addition, structured interview questions were asked to obtain information regarding demographics and medical history. Demographic information included variables such as age, marital status, number of children, educational status, work status, and monthly income.

Dietary knowledge. Participants' knowledge was assessed by 15 items originally developed by Kristal and colleagues (17), and then modified for the present study.

Label-reading knowledge. This assessment tool was developed for this program and consisted of 10 items (Cronbach's $\alpha = 0.74$) that tested the respondent's ability to interpret fat and calorie content in foods through reading sample food labels.

Attitudes about diet and health. Attitudes were assessed using a revised 10-item scale (Cronbach's $\alpha = 0.62$) (17). Items measured attitudes regarding the importance of meat, models (what friends do), attitudes about high-fat meals, and attitudes toward eating fiber-rich foods, such as fruits and vegetables, on a four-point Likert scale ("strongly agree" to "strongly disagree"). Higher scores indicated healthier attitudes toward low-fat diets.

Dietary patterns. Eating patterns were assessed using the Eating Patterns Questionnaire, a 1994 revised version of the Fat and Fiber-Related Diet Habits Questionnaire (18). In the revised questionnaire, 34 items on a four-point scale ("always" to "never") related to food patterns addressed in the program were as-

Table 1—*Baseline participants' characteristics by randomization group*

Characteristics	Treatment	Control
n	138	156
Age	41.2 ± 7.8	40.2 ± 8.2
Weight (lbs)	211.0 ± 39.0	206.1 ± 37.4
BMI	35.7 ± 6.2	35.3 ± 6.0
Relatives have diabetes	77 (55.8)	81 (51.9)
Marital status		
Married/living together	33 (23.9)	37 (23.7)
Single	54 (39.1)	70 (44.9)
Divorced/separated/widowed	51 (37.0)	49 (31.4)
Educational status		
High school or less	46 (33.3)	68 (43.6)
More than high school	92 (66.7)	88 (56.4)
At least one child in home (age <18 years)	86 (62.3)	102 (66.2)
Monthly family income ($)	1,367.8 ± 1,047.0	1,619.1 ± 1,206.7
Below poverty line	60 (47.2)	70 (48.0)

Data are *n* (%) or means ± SD. There were no significant group differences in any of the characteristics.

sessed (total scale Cronbach's $\alpha = 0.83$). Five dietary patterns were measured: "avoid fat as seasoning" ($\alpha = 0.50$), "substitution" ($\alpha = 0.61$), "modify meat" ($\alpha = 0.67$), "avoid fried foods" ($\alpha = 0.71$), and "replacement" ($\alpha = 0.61$). Higher scores on the Eating Patterns Questionnaire indicated lower fat dietary habits.

Readiness to change dietary patterns. The Staging of Eating Patterns Assessment determined participants' general readiness to perform each of the aforementioned five dietary patterns. Each pattern was assessed by one item; subjects responded to a five-point scale that indicated their degree of readiness to make or maintain changes based on Prochaska's five stages of change. Validation of this assessment measure has been previously demonstrated (19). To present the findings in a parsimonious manner, stages were combined to create two variables: pre-action (including precontemplation, contemplation, and preparation) and action (including action and maintenance).

Fat and daily energy intake. Participants' daily intake of fat and energy was measured by the Food Frequency Questionnaire (FFQ). The FFQ has become a well-accepted method for quantifying usual nutrient intake because, in part, it minimizes the high intra-individual, day-to-day variability in nutrient intake without relying on multiple day assessments of actual foods consumed. The FFQ used in the present study was developed for the Women's Health Trial-Feasibility Study in Minority Populations (20).

Height and weight. Each subject's height and weight were assessed while she was wearing indoor clothing without shoes. Body weight was measured using a Health-O-Meter physician beam scale. Scales were calibrated quarterly using standard weights. BMI was calculated by taking the subject's weight divided by her height squared.

Data analysis

The design of this study was a two (treatment versus control) by three (pretest, posttest, and follow-up) factorial design. For outcome measures that were either interval or ratio level measures, differences between the two conditions (pre- versus posttest and pretest versus follow-up) were tested using the ANCOVA procedure, with baseline values as the covariate. The *t* statistics and associated two-tail significance levels were based on the post hoc comparisons of each outcome measure between treatment and control conditions. For the staging of dietary patterns (action versus pre-action) variables, ANCOVA via logistic regression was used to determine significant differences between conditions.

Subject characteristics and participation

The sample consisted of 294 African-American women who completed the pre- and posttest and follow-up assessments. Table 1 compares the sociodemographic characteristics of the participants in the treatment and control groups at baseline assessment. Comparisons between the participants in the two conditions indicated that there were no significant differences between the treatment and control groups in any of the participant characteristics. The retention rate for study participants was 73.7%. Comparisons were made to determine if there were any differences between the women who completed pre- and posttest and follow-up assessments ($n = 294$) and those who dropped out of the study ($n = 104$)—that is, completed pretests, but not posttests and follow-up tests. Results showed that those who completed the study were older than the dropouts (mean age 40.7 vs. 37.3 years, respectively; $t(396) = 3.75$, $P < 0.001$). Participation rates among those that completed the study showed that 68.6% attended at least 10 of 12 possible sessions (mean = 9.4 sessions).

RESULTS

Readiness To Change Dietary Patterns

Overall, participants in the treatment group reported a greater readiness to change their dietary patterns than those in the control group at the posttest assessment. Table 2 shows the percent of participants who reported being in the action stages (versus the pre-action stages) to perform each low-fat dietary pattern. χ^2 tests of the treatment effect, controlling for pretest scores via logistic regression, were significant for all dietary patterns. These significant differences were maintained at follow-up assessment.

Dietary knowledge and attitudes

As shown in Table 3, between-group comparisons of the knowledge of fat in diet at the posttest assessment revealed that there was a significant difference between the treatment and control groups ($F[2,289] = 58.38$, $P < 0.0001$). The treatment group had significantly higher scores than the control group, after adjusting for the baseline scores. This difference remained significant at the 3-month follow-up assessment ($F[2,290] = 76.26$, $P < 0.0001$). Skill-based knowledge as measured by the Knowledge of Label Reading Questionnaire also showed significant differences between groups at the posttest assessment ($F[2,290] = 141.71$, $P < 0.0001$) and remained significant at the follow-up assessment ($F[2,291] =$

Table 2—*Between-group comparisons of readiness to change dietary patterns*

Readiness to change dietary patterns	Pretest			Posttest			Follow-up		
	Treatment	Control	χ^2	Treatment	Control	χ^2	Treatment	Control	χ^2
Substitution	53.3	51.9	0.05	89.1	54.5	37.7§	78.8	60.9	11.0‡
Avoid fat as seasoning	44.5	46.2	0.08	88.3	59.0	29.8§	86.1	60.3	24.3§
Avoid fried foods	40.9	39.1	0.10	80.3	53.2	23.9§	73.0	57.1	8.0†
Modify meat	43.8	57.1	5.13*	84.7	56.4	31.7§	82.5	58.3	28.6§
Replacement	40.9	46.8	1.04	75.9	57.1	13.8‡	72.3	59.6	6.4*

Data are %. Treatment group, $n = 138$; control group, $n = 156$. Presented in percent of subjects in action (versus pre-action) stage within each eating pattern. Baseline values were used as covariates in the ANCOVA via logistic regression procedures for between-group comparisons for posttest and follow-up outcomes. *$P < 0.05$; †$P < 0.01$; ‡$P < 0.001$; §$P < 0.0001$.

133.49, $P < 0.0001$). Comparisons of the participants' attitudes about diet and health revealed that there were no significant differences between the treatment and control groups at the postintervention or 3-month follow-up assessments.

Actual dietary patterns

The impact of the intervention indicated significant differences in the participants' actual dietary behaviors (Table 3). Assessment of the participants' dietary behaviors showed that the treatment group reported significantly more low-fat dietary patterns (total score) compared with the control group at the posttest ($F[2,286] = 97.71$, $P < 0.0001$) and follow-up assessments ($F[2,290] = 57.38$, $P < 0.0001$). Analyses of the separate dietary patterns were consistent with the results of the total scale, except for one pattern: there was no significant difference between the treatment and control groups in "replacement" at the posttreatment and follow-up assessments.

Dietary fat intake and weight

As shown in Table 3, dietary fat intake measured by the FFQ at the posttest assessment revealed a significant difference between the treatment and control groups. At posttest, the intervention was effective in reducing fat intake, as measured by the percent of calories from total fat ($F[2,290] = 33.96$, $P < 0.0001$). The post hoc *t* tests indicated that the treatment group reported significantly less fat intake than the control group, and that the differences were maintained at the follow-up assessment ($F[2,291] = 29.52$, $P < 0.0001$). The actual percent of calories from fat for the treatment group was reduced from 35.9% at pretest to 32.1% at posttest and 32.3% at follow-up, versus the same values for the control group (36, 35.6, and 34.5%, respectively).

Fat intake, as measured by the percent of calories from saturated fat, was also significantly reduced in the treatment group from pre- to posttest assessment ($F[2,290] = 30.85$, $P < 0.0001$). The post hoc *t* tests showed that the treatment group reported significantly less fat intake than the control group and that these differences were maintained at follow-up ($F[2,291] = 25.59$, $P < 0.0001$). The total daily energy intake of the treatment group was significantly lower than that of the control group from the pre- to posttest assessment ($F[2,290] = 46.96$, $P < 0.0001$) and at follow-up ($F[2,291] = 30.75$, $P < 0.0001$). Despite significant reductions in fat intake, results indicated that no significant group differences were detected in the weight and BMI of the participants.

Table 3—*Results of ANCOVA: pretest, posttest, and follow-up means in treatment and control conditions*

Variables	Baseline			Posttest (3 months after baseline)			Follow-up (6 months after baseline)		
	Treatment	Control	*t*	Treatment	Control	*t*	Treatment	Control	*t*
Dietary fat knowledge	5.5	5.4	−0.53	6.1	5.6	2.87†	6.3	5.7	4.21§
Label reading knowledge	6.4	6.6	0.70	7.2	6.7	3.39‡	7.1	6.8	2.12*
Attitudes about diet and health	2.7	2.7	1.23	2.7	2.7	1.64	2.8	2.7	1.79
Dietary patterns (Total)	2.2	2.2	0.89	2.6	2.2	8.62‡	2.5	2.2	5.98§
Substitution	2.0	2.0	0.02	2.7	2.1	7.04‡	2.7	2.1	5.89§
Avoid fat as seasoning	2.4	2.4	−0.42	2.7	2.4	5.78‡	2.7	2.4	4.97§
Avoid fried foods	2.5	2.5	0.37	3.0	2.5	6.17‡	2.8	2.5	3.63‡
Modify meat	2.2	2.3	1.57	2.9	2.3	6.81‡	2.7	2.3	4.23§
Replacement	1.9	2.0	2.05*	1.9	1.9	1.70	1.9	1.8	1.96
Daily energy (kcal)	1099.9	1291.0	−1.13	1122	1272	−2.92†	1089.5	1315.7	−3.50‡
Calories from fat (%)	35.9	36.0	0.03	32.1	35.6	−4.01‡	32.3	34.5	−2.50*
Calories from saturated fat (%)	12.4	12.4	0.00	10.8	12.3	−4.39‡	10.9	12.0	−3.00†
Weight (lbs)	211.0	206.1	−1.09	212	206	.96	209.4	207.6	1.30
BMI	35.7	35.3	−0.63	35.9	35.2	1.32	35.7	35.4	1.31

*$P < 0.05$; †$P < 0.01$; ‡$P < 0.001$; §$P < 0.0001$. Data are means and represent results of ANCOVA for treatment ($n = 138$) and control ($n = 156$) groups. Baseline values were used as covariates in the ANCOVA procedures. The *t* statistics were based on post hoc comparisons. All significance tests were two-tailed.

CONCLUSIONS — This study addressed the following question: To what extent does a peer-led program that tailors content to participants' readiness to make dietary changes reduce fat intake and increase low-fat dietary patterns, and maintain these changes over a follow-up phase? Other intermediate outcomes of interest included increasing skill-based knowledge (e.g., label reading) and knowledge and attitudes about dietary fat. The EWLW was evaluated using an experimental design with 3-month intervals between pre- and posttest assessments and posttest and follow-up assessments.

A critical finding in this study was that greater reductions were seen in fat intake of the EWLW group when compared with the control group and that the reductions were maintained at the 3-month follow-up assessment. At the posttest assessment, women in the EWLW condition had reduced their fat intake by 3.8% vs. 0.4% for the control group. At follow-up, fat intake remained significantly lower in the EWLW than in the control group (32.3 vs. 34.5%), which brought the former group closer to the public health goal of ≤30% of calories from fat, as recommended by the Healthy People 2000 guidelines (21). Within-group comparisons of the control group showed a slight decrease in fat intake from pretest to follow-up assessment. One possible reason for the decrease in fat intake in the control group is the effect of testing. Because subjects completed three 45-min food frequency questionnaires over 6 months, it is possible that by the follow-up assessment, the control group subjects had increased their awareness of fat and overall food intake simply by completing the questionnaires, and that this influenced their eating habits. This is particularly plausible given that the women in the control condition were motivated to change their eating habits, as evidenced by the fact that they responded to our recruitment efforts and may have sought out other strategies to modify their eating patterns outside of our program.

A second finding was the significant increases in low-fat dietary patterns among the EWLW group compared with the control group at posttest and follow-up assessments. It is likely that changes in dietary patterns led to the reduction of total fat intake. This was true across all dietary patterns except for "replacement" (replacing high-fat foods with fruits, vegetables, grains, and bread). Several explanations for why participants did not make significant changes in this dietary pattern are possible: *1*) content on "replacement" was delivered in the 11th session (out of 12 sessions), and 38.7% did not receive the content on "replacement" because of attrition; *2*) the program did not emphasize increasing intake of fiber (i.e., fruits and vegetables), but rather focused on reducing total fat; and *3*) this pattern may involve a greater change in cuisine in that the replacement food looks and tastes different than the high-fat food. The data on increasing participants' readiness to change dietary patterns is consistent with the above-mentioned findings on dietary patterns. A greater percentage of participants in the treatment group moved from pre-action to action stages across all dietary patterns, and maintained their significant gains at the follow-up assessment.

Intermediate outcomes, such as knowledge of fat in foods and reading and interpreting food labels, were increased and maintained for the participants in the treatment group when compared with the control group. Attitudinal change was not influenced by the intervention. This may be in part have been because of the low-to-fair reliability of the total attitudinal scale ($\alpha = 0.62$). Another explanation for this result may be that attitudes about food and dietary preferences are difficult to change because they are embedded in family tradition and ethnic and cultural practices.

There was no significant weight loss among participants at the follow-up assessment. The reasons for the lack of weight loss are unclear. This finding may be attributable to measurement problems associated with dietary assessment. Specifically, it is possible that the women in both conditions, either through social desirability or difficulty in recalling intake over the previous month, underreported their intake. However, there was consistency in underreporting across pre- and posttest and follow-up assessments and across conditions, which lends some support to the suggestion that the differences between groups may have been real.

It is important to note that the objective of the EWLW was not to lower caloric intake but to lower fat intake and change dietary patterns, a recognized strategy for reducing the risk of diabetes (5,6). This focus, which proved effective, was culturally appropriate, as African-American women are not generally as concerned about weight loss as their Caucasian counterparts (22–24). Also, changing dietary patterns may be a first step toward other diabetes risk-reduction strategies, as successful attainment of more immediate goals holds relevance as a motivating factor for more long-term prevention goals (e.g., maintaining weight loss).

Finally, these findings do not negate the importance of weight reduction in diabetes prevention, but rather suggest what strategies might work for certain outcomes in this population. Reduction in fat intake alone does not necessarily result in a reduction of weight. Future programs that emphasize increases in fiber (fruits and vegetables) and physical activity, in addition to decreases in fat intake, may be more effective in decreasing weight and BMI than the EWLW.

In conclusion, the gathered data indicated that a stage-based intervention conducted by trained peer leaders in the community is effective in changing dietary patterns and reducing fat intake among low-income African-American women. The EWLW program uses strategies that could be expanded to include a greater emphasis on physical activity and increased fiber intake. A peer-led approach with the collaboration of a community organization that is located in the target neighborhoods holds promise for reducing the risk of diabetes among lower-income African-American women.

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