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Predictors of Weight Loss for African-American Women in the Faith, Activity, and Nutrition (FAN) Study

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Abstract

Background: Understanding predictors of weight loss can assist in developing targeted evidence-based programs to reduce obesity in faith-based settings. The purpose of this study was to examine predictors of weight loss for a sample of African-American women taking part in in a church-based study.

Methods: Participants (N = 350) completed physical assessments and comprehensive surveys at baseline and 15-months later. Analyses examined baseline variables and change in variables from baseline to posttest, as predictors of ≥5% weight loss at posttest. Demographic, health-related, and behavioral variables were examined.

Results: Lower baseline stress predicted greater likelihood of weight loss. Increased leisure-time physical activity (LTPA) from baseline to posttest was predictive of greater weight loss. The odds of ≥5% weight loss was 38% lower for every 1 point increase in baseline stress (OR=0.62, CI=0.39, 0.98, p=0.04) and 6% greater for every 1 hour increase in posttest LTPA (OR=1.06, CI=1.0, 1.12, p=0.049).

Conclusions: Increased LTPA appears to be an independent predictor of modest but meaningful reductions in weight among African-American women. African-American women reporting higher levels of stress at baseline may require more intense strategies emphasizing increased LTPA to lose weight.

Keywords

physical activity; faith-based; public health; weight; African-American women

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This study is registered at www.clinicaltrials.gov (NCT00379925).

Introduction

Obesity is one of the foremost public health concerns in the United States, contributing to numerous chronic diseases, premature morbidity and mortality and diminished quality of life. Overweight (body mass index [BMI] ≥ 25 kg/m^2 and < 30 kg/m^2) and obesity (BMI ≥ 30 kg/m^2) are more prevalent among African-American adults than Caucasians, with African-American women having the highest rates (82%)[1]. African-American women experience disproportionate morbidity and mortality due to obesity-related chronic conditions, including type 2 diabetes, cardiovascular disease and certain types of cancer [2-4]. As such, one of the primary goals of Healthy People 2020, a comprehensive preventive health initiative for the nation, is to eliminate health disparities among subgroups of the population who are vulnerable to higher levels of chronic conditions [5].

These inequities are not limited to overweight and obesity but to the contributing health behaviors as well. In 2007, about half of Caucasian women versus 36.3% of African-American women met physical activity (PA) guidelines according to self-report data[6]. In 2009, 24.3% of Caucasians versus 21.5% of African-Americans reported consuming fruits and vegetables five or more times per day[7]. African-American women also report higher rates of chronic stress, stressful environments and stressful life events compared with their non-Hispanic Caucasian counterparts [8,9]. These behavioral and lifestyle factors, as well as demographic and economic characteristics, may contribute to overweight and obesity for African-American women.

The church community represents a critical social context for interventions targeting the vulnerable subgroup of African-American women. The church has been a long-standing source of support and plays an integral role in the lives of African-Americans [10,11]. The church has also been a setting for successful health ministry, offering health education and provision of health care services [10]. According to the Pew Research Center's Forum on Religion and Public Life, 84% of African-American women say religion is very important to them, and 59% say they attend religious services once a week [12,13]. Thus, the church may be an ideal setting for implementing faith-based healthy lifestyle programs, with support from pastors, health directors and other church leadership and members.

Findings from recent studies indicate that even modest weight loss of 5-10% of bodyweight is associated with decreased cholesterol, decreased blood sugar and improved lipid profiles [14-17]. For example, in the Diabetes Prevention Program (DPP), weight loss of 7% combined with PA and dietary changes resulted in a 58% reduction in the incidence of diabetes relative to a placebo in an at-risk population [18]. Therefore, PA and nutrition programs resulting in modest weight loss, particularly for vulnerable subgroups, may be important, as they can not only impact obesity, but related comorbidities as well.

A critical aspect to developing effective interventions that can reduce the burden of obesity on African-American women includes understanding variables that predict and contribute to weight loss in this population. Such predictive factors can be useful in identifying who is more or less likely to make the targeted changes and succeed with a lifestyle intervention. Insights gained from research into predictive and critical change factors can be valuable in

developing future evidence-based programs. For example, individuals lacking the characteristics associated with the targeted behavior (i.e., weight loss) upon program entry can be identified from the onset. Additional steps can be employed to improve the modifiable factors (e.g. PA, self-efficacy) associated with the targeted behavior, perhaps prior to the initiation of the intervention. Although non-modifiable factors cannot be changed (e.g. age, gender), more intense and/or additional strategies can be used in an effort to enhance the likelihood of positive outcomes.

The purpose of this study was to examine demographic, health-related, and behavioral variables (at baseline and change from baseline to posttest where applicable) as predictors of successful moderate weight loss (≥5% bodyweight) in a sample of African-American women taking part in a faith-based PA and dietary intervention. These types of analyses are hypothesis-generating rather than hypothesis-testing and can be used to inform future practice.

Methods

The study uses data from the Faith, Activity, and Nutrition (FAN) program, which has been previously described in detail elsewhere [19,20]. To summarize, FAN was a PA and nutrition intervention implemented in African Methodist Episcopal (AME) churches in SC. FAN used a community-based participatory research approach in which a planning committee consisting of church leaders, lay members of the church, and university staff worked together at all stages of the research project to develop, implement, and evaluate the program. FAN used a group randomized design and implementation took place in three waves. Churches were randomized to receive the intervention immediately following baseline assessments (i.e. intervention group) or at the end of the 15-month intervention period, following post measurements (i.e. control group). The primary goals of FAN were to increase moderate to vigorous intensity PA and fruit and vegetable consumption, and to improve blood pressure; secondary aims were to decrease fat-related behaviors, including consumption of high-fat foods and meats, and adding fats as flavoring, and to increase fiber-related behaviors, such as consuming and substituting more high-fiber produce and grains[19]. Primary and secondary outcomes of the study have been published; intervention churches showed significantly increased leisure-time PA (LTPA) and fruit and vegetable consumption relative to control churches[20]. The study was approved by the University of South Carolina Institutional Review Board.

Procedures

Presiding elders sent pastors from 4 geographically-defined AME districts in South Carolina a letter introducing the FAN program and inviting participation [19,20]. Program staff made follow-up telephone calls to pastors to provide more details about the FAN program and to answer questions. Liaisons from interested churches recruited members of their congregation to take part in a measurement session at baseline (pre intervention). Recruitment goals were a function of church size: 13, 32, and 63 members for small, medium, and large churches, respectively. Participants completed an informed consent form approved by the Institutional Review Board at the university and by the FAN planning

committee. To be eligible, participants had to be ≥18 years old, free of serious medical conditions or disabilities that would make changes in PA or diet difficult, and attend church ≥1 time a month. Upon providing consent, trained staff took physical assessments and participants completed a comprehensive survey. The same measures were repeated 15 months later (posttest).

Intervention

The intervention targeted environmental and organizational changes within the church. The intervention targets were guided by the structural ecologic model [21], whereby churches were trained to implement intervention activities, focusing on PA and healthy eating that targeted each of the four structural factors within the model: availability, physical structures, social structures and policies, and media and cultural influences. Although churches had a great deal of flexibility in what specific intervention activities they implemented, they were asked to implement some core activities, focusing on PA and healthy eating, that were consistent across churches: distribute bulletin inserts, share messages from the pulpit, pass out educational materials, create a FAN bulletin board, and suggest policies and practices the pastor could set (e.g. incorporate PA breaks into church meetings).

Each church formed a committee and attended a training where they developed a formal intervention plan (that included the activities described above) that was in line with the overall FAN objectives. Upon submission, churches received a stipend to assist with FAN-related activities. Each church also sent two individuals to a cooks training that focused on the Dietary Approaches to Stop Hypertension (DASH) diet plan. The goal of the training was to provide church cooks with the knowledge and skills necessary to prepare healthy and flavorful foods that nourish and satisfy their congregations [22].

In addition to the trainings, committees, cooks, and pastors received monthly mailings over the intervention period to help support delivering the intervention. The mailings focused on PA or healthy eating, a health condition related to inactivity or dietary habits, and highlighted a health behavior change strategy consistent with the social cognitive theory [23]. Finally, technical assistance calls from study staff were made to assist the pastor, cook, and FAN coordinator with any challenges they may have encountered. More details of the committee training, cooks training, monthly mailings, and technical assistant calls can be found elsewhere [19,22].

Measures

Sociodemographic and health variables.

Participants self-reported their age, gender, race, marital status, education, and the number of children under the age of 18 living in their household.

Self-reported presence of diabetes, hypertension, myocardial infarction, angina, stroke, arthritis, osteoporosis, asthma, high blood cholesterol was assessed. Resting blood pressure was also taken using standard procedures[24]. Participants with a systolic blood pressure >140 mmHg, a diastolic blood pressure >90 mmHg, or answering “yes” to the self-report question

were classified as hypertensive. The total number of health conditions participants reported having was calculated.

Body Mass Index (BMI).

Height to the nearest quarter inch and weight to the nearest 1/10 kilogram were obtained by trained staff. BMI was calculated as kg/m^2 using standard procedures.

Fruit and vegetable intake.

The National Cancer Institute (NCI) Fruit and Vegetable all-day screener measured FV consumption (cups/day) in the past month [25]. Nine of the original ten items were used (French fry consumption was excluded) [26]. This instrument has shown acceptable psychometric properties [27,28]

Physical activity.

A 36-item modified version of The Community Health Activities Model Program for Seniors (CHAMPS) questionnaire[29] assessed the frequency and duration of physical activities "in a typical week during the past 4 weeks." This measure has been shown to have strong psychometric properties [29,30]. Hours per week of moderate-to-vigorous LTPA (≥ 3.0 METs, household and related activities removed) was calculated.

Fat and fiber intake.

The Fat and Fiber-Related Behavior Questionnaire [31] assessed fat- (27 items) and fiber-related (14 items) dietary behaviors over the past three months. The fat-related items measured the extent to which participants avoided fat as flavoring, substituted low-fat foods for high-fat foods, modified meats to be low in fat, replaced high-fat meats with lower fat alternatives, and replaced high-fat foods with fruits and vegetables. The fiber-related items measured the extent to which participants ate high fiber cereals and grains, ate fruits and vegetables, and substituted high-fiber for low-fiber foods. These summary scores have shown strong psychometric properties[31,32].

Perceived Stress.

A 4-item version of the Perceived Stress Scale [33,34] measured the degree to which situations in one's life are appraised as stressful. On a scale from 1 (never) to 5 (very often), participants were asked how often, in the last month, he/she felt the way described.

Self-efficacy for PA.

Self-efficacy for PA was measured with an adapted 12-item version of Sallis' scale[35], assessing a participant's confidence to exercise when faced with common barriers. A Likert scale with four rather than five response options ("not at all confident", "a little confident," "moderately confident," and "very confident") was used, consistent with *Healthy Body/ Healthy Spirit*[36].

Self-efficacy for fruit and vegetable consumption.

Self-efficacy for fruits and vegetables was measured with a 10-item scale assessing a participant's confidence to eat fruits and vegetables when faced with common barriers. This scale was used in *Healthy Body / Healthy Spirit*[36] and *Body and Soul*[37].

Social support for PA and fruit and vegetable consumption.

Social support for PA (3 items) and fruit and vegetable consumption (3 items) from family, friends/colleagues, and members of church was assessed. Participants were asked, "How much encouragement do you get from your (family / friends or work colleagues / people at your church) to (get more physical activity / eat more fruits and vegetables)?" The items assessing family and friend/colleague support were derived from Eyler and colleagues' (1999) study involving minority women[38]. The items assessing support from people at church were similar to those used in *Healthy Body / Healthy Spirit*[36]. All items were measured on a four point response scale ("none," "a little," "some," and "a lot").

Statistical Analyses

Participants with complete baseline and posttest data were included in this study. One participant with complete data, but who was underweight at baseline, was not included in this study. Differences in demographic, health-related, and other key study variables among participants included and not included in this study were examined with χ^2 or t-tests.

Participants were classified (yes/no) as having lost ≥5% of their baseline body weight at the 15-month follow-up. Logistic regression, using SAS PROC GLIMMIX to control for church clustering, tested whether baseline variables were predictors of ≥5% weight loss. The same approach was used to test whether the posttest value of the variable of interest was predictive of ≥5% weight loss after controlling for the baseline value. Each predictor was tested in a separate model; all significant predictors ($p<0.05$) were then entered simultaneously into a model. Odds ratios (OR) and the associated 95% confidence intervals (CI) for ≥5% weight loss were calculated for each model. All models controlled for age, education, group assignment, church size, and phase.

Results

Of the 1257 total participants from 74 churches included in the primary outcomes paper, 952 (76%) were female, from whom 350 participants from 58 churches had complete pre and post data and were included in this study. Participants included in this study were more likely to be married, older, had less children, were more educated, and had higher self-efficacy for PA and fruit and vegetable consumption at baseline than those not included in this study ($p<0.05$).

There was no significant difference in weight at posttest by randomization assignment (i.e., intervention vs. control group weight loss, $p=0.72$). Therefore, participants from both groups were combined in all subsequent analyses. As shown in Table 1, on average, participants were 56.1±12.0 years old and had a BMI of 33.6±7.6 kg/m^2. Participants had less than one child under 18 living in their house hold (0.5±1.0), and had approximately two chronic

health conditions (2.1±1.6). A majority of participants had at least some college education (61%), were married (56%), had no physical limitations (83%) and were overweight or obese according to their BMI (89%).

Thirteen percent (n=47) of participants lost ≥5% of their baseline weight. Table 2 shows the adjusted ORs and the corresponding 95% CIs for associations between baseline predictor variables and ≥5% weight loss. The odds of ≥5% weight loss was 38% lower for every 1 point increase in baseline stress (OR=0.62, 95% CI=0.39, 0.98, p=0.04). None of the other baseline variables examined were significant predictors of ≥5% weight loss.

Table 3 shows the adjusted ORs and the corresponding 95% CIs for associations between posttest values in the predictor variables, controlling for baseline values and other covariates, and ≥5% weight loss. The odds of ≥5% weight loss was 6% greater for every 1 hour increase in LTPA at posttest (OR=1.06, CIs=1.01, 1.13, p=0.03). Changes in the other variables examined were not associated with ≥5% weight loss.

Baseline stress and posttest LTPA were entered simultaneously into a model (data not shown), along with covariates and baseline LTPA. Posttest LTPA (OR=1.06, CI=1.00, 1.12, p=0.05) and baseline stress (OR=0.64, CI=0.40, 1.03, p=0.06) were no longer statistically significant predictors of ≥5% weight loss, although the associations approached statistical significance. Baseline stress was not associated with baseline LT MVPA (r = −.03, p = .52) but approached significance for posttest LT MVPA (r = −.10, p = .07) and change in LT MVPA (r = −.08, p = .16).

Discussion

This study examined demographic, health-related, and behavioral variables (at baseline and change from baseline to posttest where applicable) as predictors of weight loss for African-American women in a faith-based study. We found that perceived stress at baseline and increased LTPA over the 15-month follow-up period predicted weight loss of ≥5% in our sample. These results suggest that stress and, more critically, PA may play important roles in producing meaningful reductions in weight. Thirteen percent of our sample (n=47) lost ≥5% of their bodyweight during the course of FAN. Although weight loss was not a target of the FAN intervention, behaviors associated with weight loss (i.e. PA and diet) were. Therefore, it was not surprising that a subset of participants taking part in the program experienced weight loss.

The odds of significant weight loss were 38% lower for every one point increase in stress. These results are consistent with the growing body of research that links stress with overweight and obesity. Higher stress levels are correlated with increased cortisol, which is known to promote weight retention, particularly in the abdomen [39]. Increased cortisol levels have also been linked to increased rates of chronic diseases that disproportionately affect African-American women, including hypertension, cardiovascular and metabolic disease [40-42]. Our study suggests that African-American women may be less likely to experience meaningful weight loss when their stress levels are elevated. It is also possible that high

levels of stress interfere with increasing LT MVPA or modifying one's diet, and therefore the effects of stress on weight may be indirect.

Increases in LTPA over the 15-month study were found to be predictive of ≥5% weight loss in our sample. For every 1 hour increase in self-reported weekly LTPA, the odds of ≥5% weight loss increase by 6%. These results are encouraging as a primary outcome in the FAN program was to increase PA. Participants who successfully increased their LTPA were more likely to also achieve meaningful weight loss. This is a crucial and meaningful secondary outcome for our study population, where the mean BMI was 33.6 kg/m^2 and participants had an average of two comorbidities, all of which can be positively impacted by PA. These results are encouraging and in agreement with current studies suggesting that moderate increases in LTPA (< 10 min/day) not only result in weight loss but also have the potential to moderate the impact of stress on weight loss [43-45].

To the researchers' knowledge, no other faith-based studies have examined predictors of weight loss in African-American women. However, research examining predictors of weight loss, weight gain, and weight maintenance among African-American women has been conducted in other settings. Previously, studies examining predictors of weight loss in African-American women have shown that weight loss was greater for those who were older, engaged in more frequent self-monitoring of fat intake, reported lower fat intake, had increased self-efficacy through treatment, and had increased PA prior to and during the intervention [46-49]. Similar to our findings, PA consistently emerges as one of the most common predictors of weight loss maintenance, with studies indicating that individuals who perform greater amounts of PA have improved weight maintenance [50-54]. For example, in the CARDIA study, low baseline fitness and an increase in PA were the factors most consistently associated with weight loss among overweight subjects[55]. Thus, this study provides further indication that PA may be a critical component of meaningful weight loss among African-American women. The fact that the FAN intervention did not impact weight loss, despite significant increases in PA, may relate to the small effect size for PA. Larger increases in PA may be necessary to produce weight loss[53].

Contrary to other weight loss intervention results with similar populations [56], changes in dietary behaviors were not predictive of weight loss. The FAN program did not aim to reduce caloric intake or restrict the quantity of food; instead, the dietary behavior changes focused on improving the quality of food intake, primarily in the church setting, by increasing fruits, vegetables and fiber and decreasing fats and sodium served at church meals. These dietary changes may not have translated to pervasive calorie decreases for the women in their homes or other life settings, where they spend a majority of their time. As such, the overall dietary changes would not necessarily be predictive of weight loss.

Several limitations must be considered when interpreting our findings. First, attrition rates were higher than expected, but similar rates have been reported in other PA interventions targeting African-Americans, particularly when the follow-up exceeded 6 months [57]. Although we have no reason to believe that the AME women differ substantively from other women in SC or the South in general, we do acknowledge potential differences which may

limit the generalizability beyond the AME church setting. Third, although validated measures were used, there are inherent limitations to using self-report measures.

Our study provides useful information not commonly reported in the literature on predictors of weight loss in at-risk populations. This information can be used to enhance future interventions aimed at weight loss among African-American women, particularly in a church setting. More positive weight loss results may be seen among those with low levels of baseline stress and among those who have successfully increased LTPA. More intensive intervention strategies may be needed for women reporting elevated stress upon program entry. Fortunately, women with suboptimal stress levels entering an intervention may not be disadvantaged at follow-up if they increase their LTPA during the study period. As such, faith-based weight loss interventions targeting stress-reduction and increased PA should be incorporated into future research.

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Table 1.

Baseline demographic and health-related characteristics of participants (n=350)

	n	% or Mean (SD)
Age, years	350	56.1 (12.0)
Body Mass Index (BMI), kg/m^2	350	33.6 (7.6)
# of children <18 in living in home	350	0.5 (1.0)
# of health conditions[a]	350	2.1 (1.6)
Education		
Less than HS graduate	25	7.1
HS grad or GED	110	31.4
Some college (1-3 years)	98	28.0
College graduate (4+ years)	117	33.4
Marital status		
Married	195	55.7
Not married	155	44.3
Physical limitations		
Yes	60	17.1
No	290	82.9
Weight status		
Normal weight (BMI<25)	37	10.6
Overweight (25≥BMI<30)	87	24.9
Obese (BMI≥30)	226	64.6
Leisure-time physical activity, hours/week	350	3.2 (4.5)
Fruit and vegetable consumption, cups/day	350	3.7 (3.3)
Fat-related behaviors[b]	350	2.6 (0.4)
Fiber-related behaviors[b]	350	2.9 (0.5)
Stress[c]	350	2.4 (0.7)
Self-efficacy for physical activity[d]	350	2.8 (0.8)
Self-efficacy for fruit and vegetable consumption[d]	350	3.2 (0.6)
Social support for physical activity[d]	350	2.6 (0.8)
Social support for fruit and vegetable consumption[d]	350	2.5 (0.9)

[a]Sum of diabetes, hypertension, myocardial infarction, angina, stroke, arthritis, osteoporosis, asthma, high blood cholesterol

[b]Range 1-4, lower more favorable fat- and/or fiber-related behaviors

[c]Range 1-5; lower scores indicate less stress

[d]Range 1-4, higher score indicates higher self-efficacy or social support

Table 2.

Baseline predictors of ≥5% weight loss among women taking part in FAN

	Odds Ratio (95% CI)	p-value
Education		
Less than HS graduate	0.62 (0.12, 3.20)	
HS grad or GED	1.44 (0.63, 3.30)	0.63
Some college (1-3 years)	1.38 (0.60, 3.19)	
College graduate (4+ years)	Reference	
Marital status		
Not Married	0.88 (0.45, 1.70)	0.70
Married	Reference	
Physical limitations		
No	0.86 (0.37, 1.96)	0.71
Yes	Reference	
Age, years	1.02 (0.99, 1.05)	0.21
# children in home	0.72 (0.45, 1.16)	0.18
# health conditions[a]	0.94 (0.74, 1.18)	0.58
Leisure-time physical activity, hours/week	1.01 (0.94, 1.08)	0.81
Fruit and vegetable consumption, cups/day	0.99 (0.89, 1.09)	0.81
Fat-related behaviors[b]	1.46 (0.65, 3.30)	0.36
Fiber-related behaviors[b]	1.75 (0.86, 3.54)	0.12
Stress[c]	0.62 (0.39, 0.98)	0.04
Self-efficacy for physical activity	0.72 (0.47, 1.11)	0.14
Self-efficacy for fruit and vegetable consumption	0.86 (0.51, 1.44)	0.56
Social support for physical activity	0.68 (0.45, 1.01)	0.05
Social support for fruit and vegetable consumption	0.80 (0.56, 1.16)	0.25

Note: All models controlled for age, education, group assignment, church size, and phase.

[a] Sum of diabetes, hypertension, myocardial infarction, angina, stroke, arthritis, osteoporosis, asthma, high blood cholesterol

[b] Range 1-4, lower more favorable fat- and/or fiber-related behaviors

[c] Range 1-5; lower scores indicate less stress

[d] Range 1-4, higher score indicates higher self-efficacy or social support

Table 3.

Posttest predictors of ≥5% weight loss among women taking part in FAN

	Odds Ratio (95% CI)	p-value
Leisure-time physical activity, hours/week	1.06 (1.01, 1.13)	0.03
Fruit and vegetable consumption, cups/day	1.04 (0.94, 1.15)	0.48
Fat-related behaviors[a]	1.02 (0.33, 3.17)	0.97
Fiber-related behaviors[a]	0.93 (0.37, 2.36)	0.88
Stress[b]	0.93 (0.57, 1.51)	0.76
Self-efficacy for physical activity	1.11 (0.68, 1.81)	0.67
Self-efficacy for fruit and vegetable consumption	1.31 (0.71, 2.41)	0.39
Social support for physical activity	1.15 (0.71, 1.86)	0.58
Social support for fruit and vegetable consumption	1.09 (0.70, 1.69)	0.72

Note: All models controlled for the baseline value of the predictor variable of interest, age, education, group assignment, church size, and phase.

[a]Range 1-4, lower more favorable fat- and/or fiber-related behaviors

[b]Range 1-5; lower scores indicate less stress

[c]Range 1-4, higher score indicates higher self-efficacy or social support