A Cluster Randomized Trial of a Community-Based Intervention Among African-American Adults: Effects on Dietary and Physical Activity Outcomes

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Abstract

Evidence of the effectiveness of community-based lifestyle behavior change interventions among African-American adults is mixed. We implemented a behavioral lifestyle change intervention, Heart Matters, in two rural counties in North Carolina with African-American adults. Our aim was to evaluate the effect of Heart Matters on dietary and physical activity behaviors, self-efficacy, and social support. We used a cluster randomized controlled trial to compare Heart Matters to a delayed intervention control group after 6 months. A total of 143 African-American participants were recruited and 108 completed 6-month follow-up assessments (75.5%). We used mixed regression models to evaluate changes in outcomes from baseline to 6-month follow-up. The intervention had a significant positive effect on self-reported scores of encouragement of healthy eating, resulting in an increase in social support from family of 6.11 units (95% CI [1.99, 10.22]) ($p < .01$). However, intervention participants also had an increase in discouragement of healthy eating compared to controls of 5.59 units (95% CI [1.46, 9.73]) among family ($p < .01$). There were no significant differences in changes in dietary behaviors. Intervention participants had increased odds (OR = 2.86, 95% CI [1.18, 6.93]) of increased frequency of vigorous activity for at least 20 min per week compared to control participants ($p < .05$). Individual and group lifestyle behavior counseling can have a role in promoting physical activity levels among rural African-American adults, but more research is needed to identify the best strategies to bolster effectiveness and influence dietary change. Trial Registration: Clinical Trials, NCT02707432. Registered 13 March 2016.

Keywords Cardiovascular diseases · Healthy diet · Exercise · Social support · African American · Adult

Introduction

African-Americans continue to experience significantly higher rates of cardiovascular disease (CVD) morbidity and mortality compared to other races, especially in rural areas of the Southeast (Howard et al. 2011; Vaughan et al. 2015). Complex individual, social, environmental, and economic factors influence two proximal contributors to African-American CVD outcomes: poor nutritional quality and physical inactivity. African Americans are more likely than Whites to eat a "southern diet" characterized

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by high-fat, processed meats and fried foods that add excess calories and sodium and are associated with an increased stroke risk (Judd et al. 2013). Evidence also demonstrates that fewer African-American adults are reaching recommended minutes per week of physical activity, and African Americans are more sedentary than Whites (Cockerham et al. 2017; Hooker et al. 2016). It is critical to continue to build evidence about programs designed to support healthy lifestyle behavior change among African-American adults.

Many trials implemented in academic research centers and clinical settings have provided evidence that lifestyle behavior interventions can reduce CVD risk (Elmer et al. 2006; Knowler et al. 2002; Kumanyika et al. 2002; Look et al. 2007; Look and Wing 2010; Stevens et al. 2001). These trials, however, have not been as effective for African American compared to White adult participants (Wingo et al. 2014). To improve the reach and acceptability for African Americans, researchers have implemented these interventions in community and faith-based settings, but the effectiveness has been mixed (Lancaster et al. 2014; Coughlin and Smith 2017).

Faith- and community-based lifestyle behavior interventions for African Americans typically involve strategies such as motivational interviewing and peer support that target constructs of self-efficacy and social support (Campbell et al. 2007). However, these psychosocial factors have not been evaluated consistently across intervention studies with African-American adults (Bland and Sharma 2017; Coughlin and Smith 2017; Lancaster et al. 2014). Although the constructs are proximal intervention targets, many prior studies do not report them as outcomes (Allicock et al. 2012; Duru et al. 2010; McNabb et al. 1997; Resnicow et al. 2005a, b; Samuel-Hodge et al. 2009; Yanek et al. 2001). Among the studies that have assessed change in either or both social support and self-efficacy, there is a mixture of null and significant findings (Bopp et al. 2009; Campbell et al. 1999; Faridi et al. 2010; Peterson et al. 2008; Resnicow et al. 2001, 2004; Wilcox et al. 2007; Yeary et al. 2011). In addition, most research on social support within African-American behavior change interventions has only reported positive social support, and none has evaluated negative influences such as discouragement from family and friends to engage in healthy behaviors (Geller et al. 2019).

More research is needed to understand the impacts these types of interventions have on behavior change as well as proximal psychosocial constructs (e.g., self-efficacy and social support). We used a community-based participatory research approach to adapt a lifestyle behavior change intervention, PREMIER (Appel et al. 2003; Elmer et al. 2006), for a rural African-American community. We adapted the evidence-based intervention to address cultural and local concerns, and named our adapted intervention Heart Matters (Bess et al. 2017). Our goal was to evaluate the effects of the intensive intervention phase of Heart Matters on diet and physical activity behaviors, self-efficacy, and social support.

Method

Study Design

We used a cluster randomized controlled trial to compare the Heart Matters intervention to a delayed intervention control arm. Details of the study design are published elsewhere (Corbie-Smith et al. 2018) and the trial's primary clinical outcomes are being published separately. Seven community- and faith-based organizations were recruited as host sites. For inclusion, organizations were required to have adequate facility space and commit to be an intervention site for 12 months. Three sites were randomized to immediate intervention and four sites were randomized to the delayed intervention control arm. The study was approved by the University of North Carolina at Chapel Hill's Institutional Review Board.

Participants

Each organization recruited participants from their membership base. For study inclusion, participants had to be African American, 21 or older, reside in a two-county region, and have at least one of the following CVD risk factors: pre-diabetes or diabetes, hypertension, obesity, family history of early CVD, or prior diagnosis of CVD. Participants were excluded if they had evidence of active/unstable CVD or cognitive impairment that would limit informed consent.

Intervention Procedures

Heart Matters is a 12-month, behavioral lifestyle change intervention adapted from the PREMIER intervention. More details of the adaptation process and intervention content are reported elsewhere (Bess et al. 2017). In brief, changes were made to the intervention content and how it was delivered in order to improve its relevance and acceptability for a rural African-American population. For example, nutrition advice focused on using foods available locally, family members were allowed to participate in the intervention together (PREMIER excluded family members), and the intervention was delivered through faith- and community-based organizations by lay community members (as opposed to staff at clinical centers).

Consistent with PREMIER, Heart Matters used a combination of individual and group counseling sessions led by intervention facilitators with the intention of increasing self-efficacy and social support related to diet and physical activity. The core facilitators were lay community members (e.g., teachers and retired professionals) who received training on the curricula. Specialists (i.e., nutritionists, registered nurses, and personal trainers) co-facilitated a few sessions when additional expertise was valuable. The Heart Matters curriculum involved an initial intensive 6 months of behavior change intervention sessions followed by a second 6-month maintenance period with less

frequent sessions. Over the first 6 months, Heart Matters consisted of 14 group sessions (90 min) and four individual sessions (approximately 60 min). Physical activity content focused on increasing the duration of moderate to vigorous intensity activity and included activities such as instruction on assessing intensity with a pulse rate and distribution of resource lists of local places for engaging in physical activity. Dietary content included activities such as providing tips to reduce portion sizes and discussions about grocery shopping strategies. A more detailed outline of the session topics and activities can be found in the supplemental materials. During individual sessions, a facilitator used motivational interviewing techniques to support participants' progress toward establishing, monitoring, and reaching personal diet and physical activity goals.

Throughout the intervention, the facilitators encouraged participants to think about how other people in their life could help them. For example, to negate emotional eating when feeling stressed or down, participants were encouraged to "try doing other activities that may help you deal with these feelings such as…calling a friend or family member for support." Heart Matters also used tools to facilitate communication among families about diet and physical activity changes. For example, in our adaptations of PREMIER, we incorporated a short role-playing exercise that aimed to prepare participants for communicating with family and resolving conflicts about food (i.e., *RECIPE for good communication*) (Kaplan et al. 2018).

Participants from organizations randomized to the intervention began individual and group sessions immediately after recruitment. Individuals from organizations randomized to the delayed intervention control arm began the intervention 6 months later. To keep the delayed intervention participants engaged, we mailed them monthly newsletters with non-health content, such as holiday greetings and African-American historical facts.

Data Collection Procedures

All participants completed paper surveys that were subsequently entered into an electronic database (Harris et al. 2009). All participants completed baseline assessments at the same time (both initial intervention and delayed intervention control) in group settings with adequate space to complete their responses confidentially. Participants in the initial intervention group completed surveys immediately following the final two group sessions held during the sixth month of the intervention. The delayed intervention control participants also completed surveys 6 months after baseline, approximately 1 week before they began the intervention.

Measures

Dietary Self-efficacy Dietary self-efficacy measured participants' perceptions about whether they were able to make specific changes to their diet. We used a validated instrument that included four subscales that evaluated their self-efficacy to (1) reduce calories, (2) reduce salt, (3) increase fruits and vegetables, and (4) stick to dietary changes (Sallis et al. 1988). Each subscale had five items rated on 5-point Likert-type scales ranging from 1 (I know I cannot) to 5 (I know I can), which were averaged per instrument scoring protocols. All four of the subscales had strong internal consistency ($\alpha \geq 0.80$).

Physical Activity Self-efficacy Physical activity self-efficacy measured participants' perceptions about whether they were able to make changes to their physical activity. We used a validated instrument with two subscales: (1) making time and (2) sticking to activity change (Sallis et al. 1988). The *sticking to activity* subscale had 8 items and the *making time* subscale had 4 items that participants rated on a 5-point Likert-type scale (1 (I know I cannot) to 5 (I know I can)), which were averaged. Both subscales had strong internal consistency ($\alpha \geq 0.76$).

Dietary Social Support Dietary social support measured participants' perceptions about whether their friends and family supported changes they were making in their diet. We used a validated instrument that included subscales to assess perceptions of (1) encouragement and (2) discouragement of healthy eating (Sallis et al. 1987). Each subscale was measured separately for perceived support from family members and perceived support from friends, resulting in a total of four subscales. Each of the four subscales had 7 items. The subscales assessed the frequency that family members or friends had encouraged or discouraged different types of eating behaviors during the previous 3 months, ranging from 1 (none) to 5 (very often). For example, to measure discouragement, participants were asked how often a family member, "brought home foods I'm trying not to eat." As an example of an item to measure encouragement, participants were asked how often a family member, "reminded me to eat fruits and vegetables." All four of the subscales had strong internal consistency ($\alpha \geq 0.83$).

Physical Activity Social Support Physical activity social support measured the participant's perception about whether their friends and family became involved in their exercise by means such as verbal encouragement, reminders, or direct participation. We used a validated instrument with two subscales to assess participation of friends and family, respectively (Sallis et al. 1987). Each of the subscales had 10 items about how often friends or family members participated in different types of physical activity during the previous 3 months that the respondents rated on a 5-point Likert-type scale ranging from 1 (none) to 5 (very often). For example, participants were asked to rate how often a friend, "gave me encouragement to stick with my exercise program." Both subscales had strong internal consistency ($\alpha \geq 0.94$).

Dietary Behaviors Dietary intake over the past 7 days was also measured. We measured diet using a dietary screener used in the Family Life, Activity, Sun, Health and Eating (FLASHE) study (Smith et al. 2017). The screener asks participants about the frequency of food and beverage intake over the past 7 days and has been tested with a diverse population of adults and adolescents. The screener was developed by the National Cancer Institute (NCI) based on the 26-item Dietary Screener Questionnaire (DSQ) in the NHANES 2009-10. All of the items have been cognitively tested and the majority of items have been tested for validity against 24-h recalls (National Cancer Institute Division of Cancer Control and Population Sciences n.d.).

Physical Activity Behaviors We used one question from a validated measure of usual activity (Sallis et al. 1985) from the original PREMIER study. The one question was chosen to limit respondent burden and capture the frequency of vigorous activity. Specifically, participants were asked, "Think about your usual activity level. In a typical week, how often do you do vigorous physical activity for at least 20 minutes?" Participants were advised that "vigorous activity is about the same intensity as running," and provided with other examples of vigorous activity such as aerobic classes, swimming laps, and stair-stepping. Response options included never, once a week, twice a week, or three or more times a week. The measure has shown modest correlation with more extensive self-reported questionnaires and objective measures of activity (r = 0.50), construct validity (when assessed for association with measures of physical activity self-efficacy and barriers), and test-retest reliability (r = 0.51) (Rauh et al. 1992; Sallis et al. 1989).

Implementation Fidelity Assessment

We asked facilitators to complete session logs, which included checkboxes for each of the planned activities. Facilitators were asked to denote whether or not each activity was completed and describe any circumstances that kept them from completing any activity. As an external audit, members of the research team were trained to conduct observations and complete a similar session log. The external audits were conducted unannounced for a semi-random selection of the same 4 sessions for each facilitator.

Analysis

We assessed for balance of demographics and baseline outcome measures between the intervention and control group. There were no significant differences except for age; thus, age was included in models as a covariate. For all measures, if an individual answered less than 60% of items, they were treated as missing for that measure. We used mixed regression models to analyze differences in the change in outcomes from baseline to 6 months between intervention and delayed intervention control groups, which allowed for adjustment of participant non-independence within each organization. All models included the 6-month outcome as the dependent variable and the baseline measure as a covariate. All analyses were conducted in SAS version 9.4 (SAS Institute Inc., Cary, NC) using a 5% significance level (α = 0.05).

Results

A total of 143 (n = 72 intervention, n = 71 delayed intervention control) African-American participants were recruited through the seven organizations (study flow diagram provided in supplemental materials). Of the sample, 108 participants (75.5%) completed the 6-month assessment. Participants who completed 6-month assessments were older than non-completers. Non-completers had a mean age (SD) of 50.2 years old (18.0) compared to completers who had a mean age of 59.6 (12.7) (p < .001). Completers and non-completers did not significantly differ on any other demographic or baseline outcome measure including dietary and physical activity behaviors (Table 1). Among intervention participant completers, average attendance of the 14 group sessions was 66% and average attendance of the four individual sessions was 95%.

Diet and Physical Activity Self-efficacy Outcomes

Self-efficacy to reduce salt increased significantly more among the intervention compared to delayed intervention control participants (β = 0.31, 95% CI [0.09, 0.53]) (Table 2).

Table 1 Participant demographics by trial completion status

	Completion % (n)	Non-completion % (n)	p value
Gender—female	75.0 (81)	65.7 (23)	.284
Age (mean, sd)	59.6 (12.7)	50.2 (18.0)	.001
Education			
High school or less	39.6 (42)	51.4 (18)	.463
Some college or bachelors	56.6 (60)	40.0 (14)	
More than college	3.8 (4)	8.6 (3)	
Marital status			
Married/partnered	50.5 (50)	37.9 (11)	.095
Single	33.3 (33)	48.3 (14)	
Widowed	15.2 (15)	13.8 (4)	
Income			
<20 k	36.2 (38)	48.6 (17)	.143
20–40 k	19.1 (20)	14.3 (5)	
40–60 k	19.1 (20)	17.1 (6)	
>60 k	9.5 (10)	8.6 (3)	

Table 2 Mean change in self-efficacy and social support and estimated intervention effect

Psychosocial outcome (potential range)	Intervention		Control		Treatment effect	
	N	Mean (SD)	*N*	Mean (SD)	(Intervention-control) (95% CI)	*p* value
Dietary self-efficacy to (1–5)						
Reduce calories	49	0.22 (0.76)	56	0.06 (0.60)	0.12 (− 0.09, 0.32)	0.275
Reduce salt	50	0.51 (0.81)	53	0.18 (0.76)	0.31 (0.09, 0.53)	0.006
Increase fruits and veg	49	0.04 (0.75)	56	0.06 (0.67)	0.02 (− 0.18, 0.23)	0.828
Stick to dietary change	48	0.32 (0.84)	55	− 0.05 (0.75)	0.28 (0.02, 0.55)	0.036
Physical activity self-efficacy to (1–5)						
Make time	39	0.19 (1.10)	43	− 0.04 (0.93)	0.27 (− 0.1, 0.64)	0.156
Stick to activity change	43	0.05 (1.11)	46	− 0.18 (1.16)	0.2 (− 0.19, 0.59)	0.314
Dietary social support (7–35)						
Friends encouragement	35	− 0.74 (8.92)	45	− 6.76 (7.90)	5.86 (2.69, 9.03)	0.0004
Family encouragement	32	− 0.69 (10.97)	40	− 6.23 (8.63)	6.11 (1.99, 10.22)	0.004
Friends discouragement	36	− 0.83 (9.03)	44	− 5.73 (7.24)	4.45 (1.3, 7.59)	0.006
Family discouragement	34	− 1.00 (11.48)	39	− 5.9 (8.23)	5.59 (1.46, 9.73)	0.009
Physical activity social support (10–50)						
Friend participation	41	5.95 (14.19)	47	0.3 (15.41)	5.46 (0.84, 10.08)	0.0211
Family participation	35	5.77 (16.69)	45	0.2 (11.82)	7.25 (2, 12.49)	0.0074

Similarly, self-efficacy to stick to dietary changes increased significantly more among the intervention compared to delayed intervention control participants (β = 0.28, 95% CI [0.02, 0.55]). Participants had high mean levels of self-efficacy to reduce calories and increase fruits and vegetables at baseline (4.4 and 4.6, respectively, on a scale from 1 to 5). Accordingly, the change in participant's self-efficacy on these measures did not differ significantly between the intervention and delayed intervention control groups. There were no statistically significant differences in changes in either measure of physical activity self-efficacy.

Diet and Physical Activity Social Support Outcomes

The intervention had a significant effect on both encouragement and discouragement of healthy eating (Table 2). Among intervention participants, the mean change (SD) in encouragement from family and friends was slightly decreased, − 0.74 (8.92) and − 0.69 (10.97), respectively, on a scale with a potential range of 28 points. In comparison, delayed intervention control participants had larger mean decrease (SD) in encouragement from family and friends; − 6.76 (7.90) and − 6.23 (8.63), respectively. The decreases were significantly smaller for intervention compared to the delayed intervention control participants ($p < .01$) (Table 2). Figure 1 shows a boxplot of the change in encouragement by intervention and delayed intervention control participants. The interquartile range (IQR) was wider among intervention participants than delayed intervention controls. The IQR for intervention participants spread from a negative (decreased encouragement) to positive (increased encouragement) value. In contrast, the IQR for delayed intervention control participants was wholly negative (decreased encouragement).

Among intervention participants, the mean change (SD) in discouragement from family and friends was -0.83 (9.03) and − 1.00 (11.48), respectively, on a scale with a potential range of 28 points. In comparison, delayed intervention control participants had decreases in discouragement from family and friends: − 5.73 (7.24) and − 5.90 (8.23), respectively. The treatment effect on discouragement of healthy eating was significant for both family (+ 5.59, 95% CI [1.46, 9.73]) and friends (+ 4.45, 95% CI [1.3, 7.59]). Figure 2 provides a boxplot of the change in discouragement by intervention and delayed intervention control participants. Similar to encouragement, the IQR was wider and spread from a negative (decreased discouragement) to positive (increased discouragement) values among intervention participants compared to delayed intervention controls, who had a narrower and fully negative IQR (Fig. 2). Finally, intervention participants had a significantly greater increase in social support for physical activity by both friends (+ 5.46, 95% CI [0.84, 10.08]) and family (+ 7.25, 95% CI [2.00, 12.49]).

Diet and Physical Activity Behaviors

There were no significant differences between intervention and delayed intervention control participants' changes in dietary behaviors (Table 3). There was a significant increase in

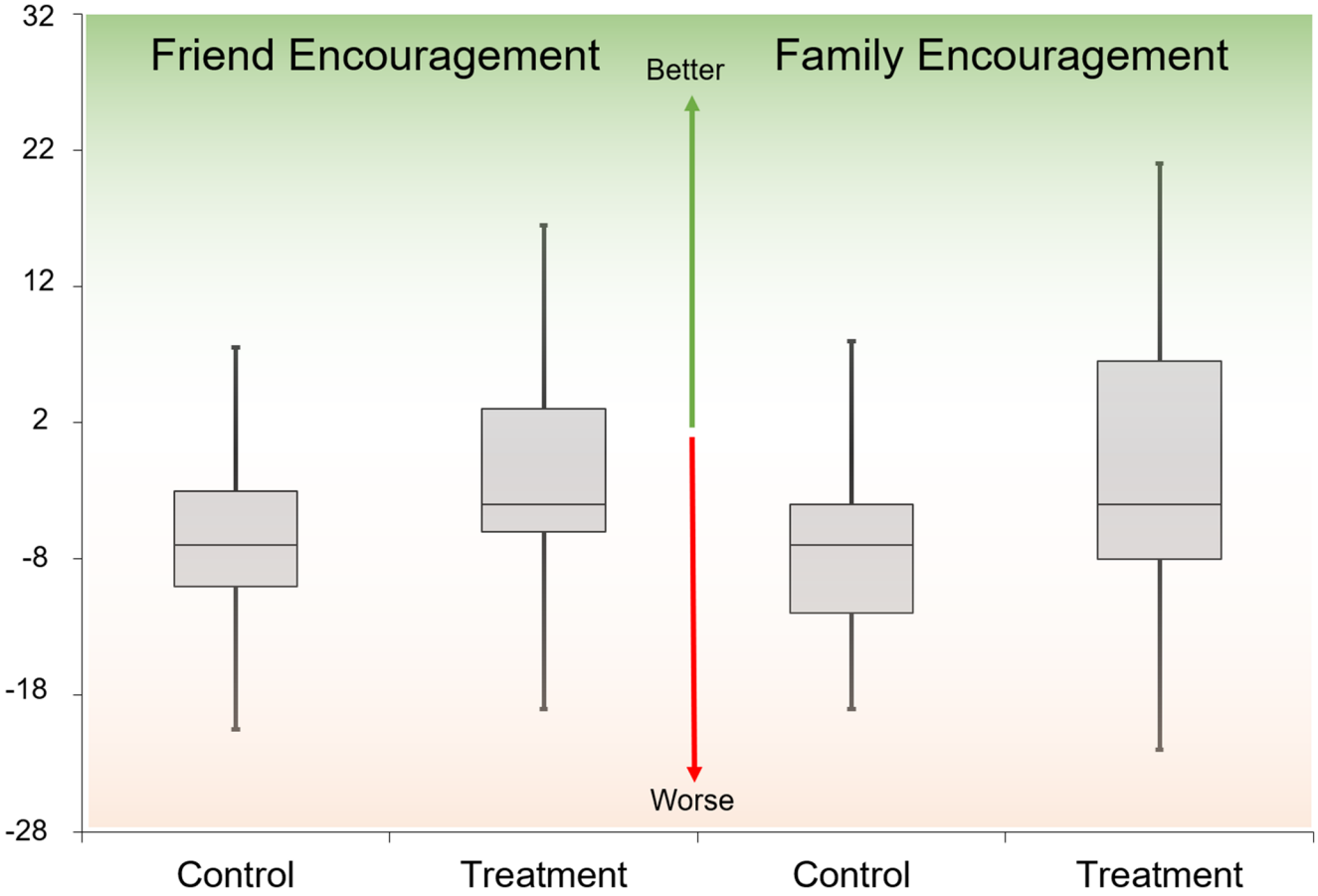

Fig. 1 Boxplot of changes in family and friend encouragement of healthy eating

the level of self-reported physical activity. Intervention participants had a significant increase in the odds (OR = 2.86, 95% CI [1.18, 6.93]) of reporting more frequent vigorous activity for at least 20 min per week compared to delayed intervention control participants.

Implementation Fidelity

An average of 57.4% of session logs were completed. Of completed logs, the facilitators noted completing 100% of activities. The external audit indicated that the activities were completed with a high degree of fidelity with almost all activities fully completed. However, one of the key activities (Taste It!) was not completed during two of the sessions (each with a different facilitator) because supplies were not secured. In each of these cases, the facilitator substituted by leading the group in a discussion about healthy food options.

Discussion

Our trial found that the Heart Matters intervention resulted in some promising, as well as unanticipated changes, in self-efficacy and social support for healthy eating and physical activity among rural African-American adults. While the intervention did not have a significant effect on dietary behaviors, self-reported vigorous physical activity increased. The findings suggest that the Heart Matters intervention may be effective for improving physical activity, but additional strategies are likely required to influence more substantial changes in diet. The observed increase in social discouragement of healthy eating among Heart Matters participants suggests that more strategies to counteract negative social influences may be needed.

We found that the intervention resulted in increased self-efficacy to reduce salt intake and stick to dietary change. The Heart Matters intervention had a substantial emphasis on salt reduction and encouraged participants to reduce salt intake by using strategies such as learning to recognize the amount of sodium on nutrition labels and using other seasonings in place of salt (Kaiser Permanente Center for Health Research 2018). It is possible that individuals found these changes easier than other dietary changes because they were substitution-driven, whereas the other changes were about increases (fruit, vegetables) and decreases (sugar-sweetened beverages). Actual food and beverage consumption patterns did not significantly change. It is possible that the changes in self-efficacy did not translate into behavior changes, or that the changes participants made were not captured by the dietary screener.

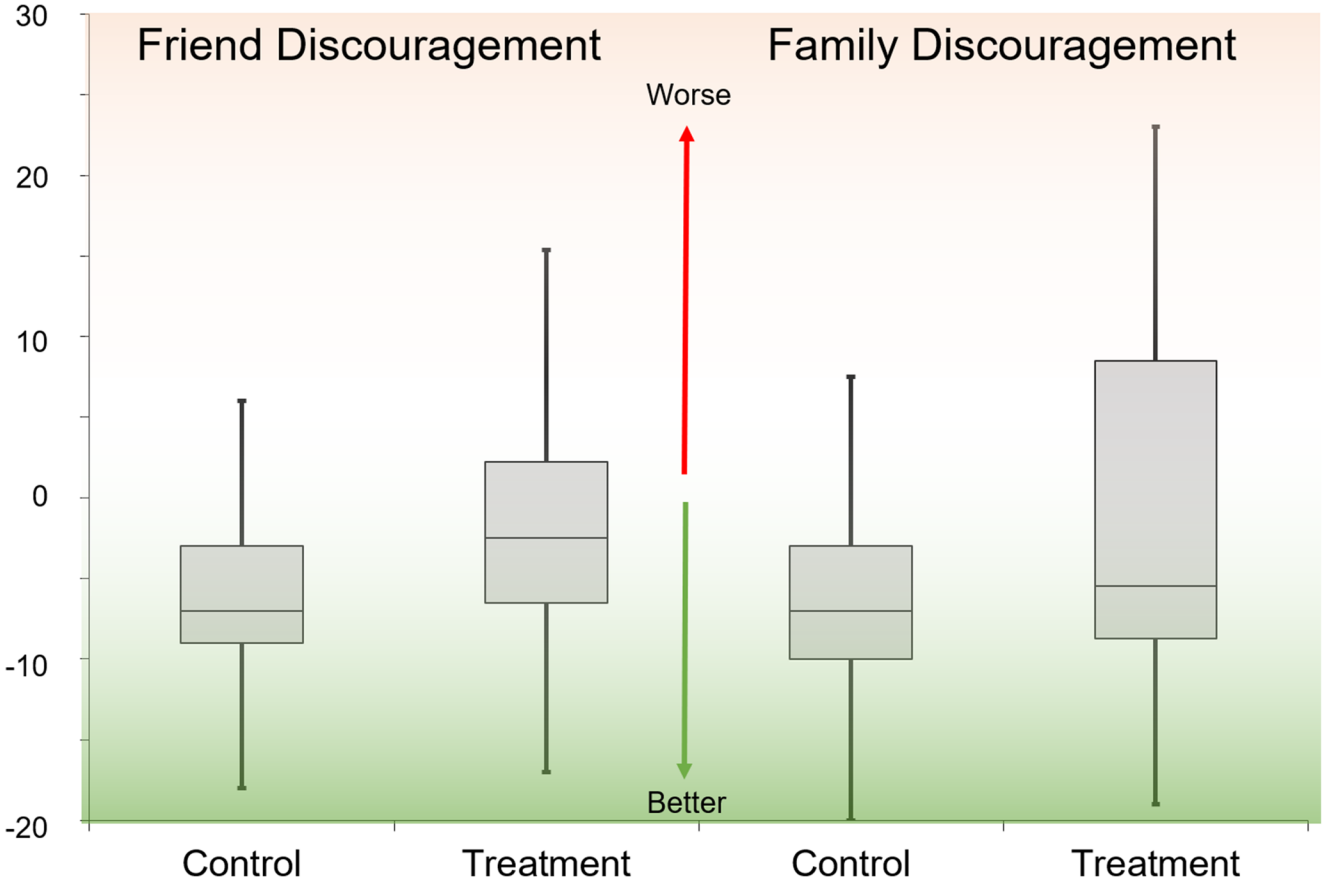

Fig. 2 Boxplot of changes in family and friend discouragement of healthy eating

Heart Matters had a significant effect on social encouragement of healthy eating. A similar lifestyle intervention targeting African Americans, Body and Soul, also found significant treatment effects on social support in early iterations (Resnicow et al. 2004), but reported null findings from later iterations of the intervention (Thomson et al. 2016). A key rationale for implementing lifestyle behavior change interventions through community and faith-based settings is that the participants will be part of an existing support network (Campbell et al. 2007). Typical of group-based formats, the delivery of curriculum in group settings is meant to foster social support to enact behavioral change. The positive group effect may have bolstered existing natural networks or initiated new connections. However, as suggested by the range from increased to decreased encouragement among intervention participants (Fig. 1), it appears that some may have had limited social connections that encouraged healthy eating within the organizations or found it more difficult to obtain healthy eating social support than others.

Interestingly, we also found that perceived discouragement of healthy eating increased more among intervention than delayed intervention control participants. To our knowledge, ours is the first CVD prevention intervention for African-American adults to assess change in discouragement of healthy eating. For Heart Matters participants, it is possible that as they attempted dietary changes, other natural social network members outside of other intervention participants (spouses, siblings, friends, etc.) were not supportive of the changes, and contributed to the increase in perceived discouragement. The distribution of the changes in discouragement (Fig. 2) suggested that although over half of intervention participants perceived decreases, many perceived an increase, especially among family members. Although the intervention provided participants with counseling about social challenges, it cannot prevent discouragement. In fact, the intervention may have heightened awareness of unhelpful behaviors from family and friends. Although the curricula included social support components, the curriculum possibly needed to allocate more time to handling social discouragement. For example, additional role playing and interactive sessions could increase the intensity of programming focused on helping participants overcome discouragement around healthy dietary choices.

In contrast to diet, we did find that the intervention improved self-reported physical activity levels and increased family and friend participation in physical activity. Among

Table 3 Mean change in diet and physical activity behaviors and estimated intervention effect

Behavior outcome	Intervention		Control		Intervention effect	
	N	Mean (SD)	*N*	Mean (SD)	(Intervention-control) (95% CI)	*p* value
Diet (servings per week)						
Fruits and vegetables	49	− 0.02 (0.35)	42	0.12 (0.46)	− 0.11 (− 0.27, 0.06)	0.193
Sugary foods	49	0.08 (0.38)	41	0.06 (0.23)	0.00 (− 0.14, 0.14)	0.995
Sugar sweetened beverages	49	0.06 (0.54)	42	0.03 (0.58)	0.04 (− 0.21, 0.28)	0.772
Non-SSB	49	0.13 (0.68)	42	− 0.08 (0.34)	0.22 (− 0.03, 0.46)	0.081
Fast/convenience foods	50	− 0.03 (0.10)	42	0.11 (0.72)	− 0.15 (− 0.36, 0.06)	0.151
Protein	49	− 0.02 (0.15)	41	0.07 (0.43)	− 0.11 (− 0.24, 0.03)	0.113
Whole grains	50	0.00 (0.12)	41	0.03 (0.16)	− 0.05 (− 0.11, 0.01)	0.132
Physical activity					Odds ratio (95% CI)	*p* value
Frequency of vigorous activity for at least 20 min (4 = three or more times, 3 = twice a week, 2 = once a week, 1 = never)	48	0.56 (1.51)	55	− 0.11 (0.92)	2.86 (1.18, 6.93)	0.020

our participants, it is possible that physical activity was relatively easier and more enjoyable to incorporate into their social systems than dietary changes. Social and cultural norms may also be more deeply entrenched around unhealthy dietary habits (Kittler and Sucher 2001) than physical activity patterns for African-American adults. Furthermore, many strategies to improve physical activity can be implemented without a direct financial cost, whereas changes needed to improve dietary habits may be perceived as and have been shown to be more costly than diets with lower nutritional value (Darmon and Drewnowski 2015). In this community, perceived or actual financial concerns may have influenced dietary choices to a greater degree than physical activity.

Our study has several limitations. The sample size was small, which limited power to detect changes in outcomes and results may not be generalizable to other populations. The measures were self-reported and subject to recall and social desirability bias. The physical activity measure was relatively crude (one question with a Likert-type response) and thus the changes observed are liberal estimates. However, there is evidence that self-reported physical activity measures are accurate for assessing intense activity levels and are appropriate to measure of change across groups (Sylvia et al. 2014). Similarly, the dietary screener measure reduced participant burden, per our community partners' recommendations, but may not have been sensitive enough to detect small changes in the frequency of foods and beverages consumed, and we did not estimate the quantity consumed. The measures of social support also do not specifically identify who provides (or does not provide) support. Thus, there is no way to identify specifically who (e.g., other intervention participants, spouses, children) the participants perceived encouraged and discouraged health behaviors, which would affect future intervention decisions. Finally, although the facilitators' self-assessments indicated implementation fidelity, they were self-reported and not completed consistently, and the external audits represented a small selection of sessions. Thus, these findings were not comprehensive and there may have been differences in implementation that influenced results not captured by our evaluation.

Our findings indicate that individual and group lifestyle behavior counseling can have a role in promoting self-efficacy, social support, and behavioral changes leading to healthier diet and physical activity among rural African-American adults, but more research is needed to identify additional strategies to increase the effectiveness of such programs. New strategies should be considered to address social support around dietary change in a more comprehensive way. Our research also found a wide range of positive to negative changes in social encouragement and discouragement of healthy eating among intervention participants, suggesting that some participants may have been more satisfied and responsive to the intervention or that some participants found it easier than others to obtain appropriate social support. More research is needed to understand the types and sources of social support relevant for helping African Americans make physical activity and dietary changes. Future intervention research with this population should consider more in-depth assessments of participant's social networks, including measures such as perceived closeness and influence. This type of information could help inform the development of methods to identify intervention participants who are likely to have social support challenges and need additional resources.

The limited change in diet also suggests that individual- and group-based counseling alone is not sufficient for significantly changing dietary behavior. There have been calls for more multi-level intervention research (Melvin et al. 2013; Taplin et al. 2012), and there is some evidence to suggest that

multi-level interventions have potential to reduce racial and ethnic health disparities (Gorin et al. 2012). Future research should test additional strategies that target other levels of change (environment, social support, etc.) in conjunction with more individually focused interventions such as Heart Matters.

In summary, we found evidence that Heart Matters, an individual and group counseling intervention for lifestyle behavior change, is promising to improve self-reported diet and physical activity among African-American adults, but more research is needed. We found changes in social support among intervention participants that highlighted the potential importance of addressing both positive and negative social influences on behavior change, especially diet. In order to reduce African-American CVD disparities, more work is needed to develop and test more extensive multi-level strategies that address more than individual- and group-counseling based interventions alone can deliver.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards

Informed Consent Informed consent was obtained from all individual participants included in the study.

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