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Adaptation of a Modified DASH Diet to a Rural African American Community Setting

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Abstract

Introduction—Cardiovascular disease is the leading cause of death among African Americans in the U.S., with high blood pressure and obesity being two of the main determinants. The Dietary Approaches to Stop Hypertension diet is effective in changing behaviors associated with these health concerns, but has not been adapted to community settings.

Methods—Men on the Move: Growing Communities (MOTMGC) was evaluated using a quasi-experimental cross-sectional design. Surveys were conducted with rural African Americans aged 18 years prior to the intervention (2008) and at the end of the project (2013), with the final analysis conducted in 2015. Using a community-based participatory research approach, MOTMGC provided culturally appropriate education and changes to the environment to improve access to fruits and vegetables, low-fat, and low-sodium foods.

Results—Declines in prevalence of overweight and obese respondents and hypertension were seen in the intervention but not the comparison county. Participants with high levels of participation reported eating five or more servings of fruits and vegetables a day, a greater variety of fruits and vegetables, less salt, and seasoning their vegetables with less fat more often than those who did not participate in educational activities. Participants reported that as a result of their access to MOTMGC gardens, they were more likely to eat more fruits, vegetables, and locally grown food, and less processed food and fast food.

Conclusions—Adapting the Dietary Approaches to Stop Hypertension diet to community settings through culturally appropriate community-based efforts can improve dietary behaviors, BMI, and blood pressure.

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Introduction

Cardiovascular disease is the leading cause of death among African American men and women in the U.S., with high blood pressure and obesity being two of the main contributing factors.^{1,2} Nutrition is one of the main predictors of both obesity and high blood pressure. Though there is debate about specific diets that reduce obesity and high blood pressure, there is general agreement that increasing fruit and vegetable consumption and decreasing consumption of sodium and fat are important.

The Dietary Approaches to Stop Hypertension (DASH) diet has been recommended as one way to improve dietary behaviors and decrease hypertension.³ DASH/DASH+sodium diet encourages consumption of whole grains, low-fat dairy products, and fruits and vegetables, while minimizing consumption of fats and sodium. The original DASH trials were RCTs, and provided all food for participants.^{3–5} Initial trials of DASH showed a decrease of 5.5 mmHg in systolic blood pressure and 3.0 mmHg in diastolic blood pressure.^{3–5} Subsequent trials (with and without sodium reductions) that required participants to plan menus and purchase foods showed reduction in adherence to DASH and subsequently smaller reductions in blood pressure.^{6,7} These later trials also found racial differences in adherence, with African Americans being less likely to adhere to the DASH diet when required to plan menus and purchase foods than whites.³ These studies suggested that these adherence differences were likely influenced by food availability, cost, and culture and that additional adaptations and multilevel interventions may therefore be necessary to maximize impact of the DASH diet in African American communities.^{3,8} This is consistent with research that has concluded that, to be effective in decreasing disparities, nutrition interventions must address a combination of individual, social, cultural, and environmental determinants.^{9–18}

This paper presents findings from an intervention that adapted the DASH+sodium recommendations into an African American community setting using a multilevel intervention and worked with community-based organizations and businesses to provide culturally appropriate education and changes to the environment to improve access to fruits and vegetables as well as low-fat and low-sodium foods.

Methods

Men on the Move: Growing Communities (MOTMGC) used a community-based participatory approach to address individual, environmental, and social determinants of cardiovascular disease. Although parts of MOTMGC focused specifically on men, this paper describes the design and implementation of one part of this project that included both African American men and women—culturally appropriate nutrition education provided by community health advocates and based on the DASH+sodium diet, along with increasing access to improve the opportunity to make heart healthy choices.

The MOTMGC intervention created six community and production (produce was given and or sold to retail outlets/restaurants) gardens. Local community residents were trained to manage the gardens, which generated >7,300 pounds of produce during the project. Produce was distributed directly to community members through a farm stand run by MOTMGC, as

part of a regional farmers market, as well as to local convenience stores, restaurants, and community-based organizations. The two largest grocery stores in the intervention area agreed to carry additional low-fat and -sodium products (e.g., low-fat dairy, ground turkey) as defined by the investigators and placed heart healthy “shelf talkers,” or point-of-purchase signs by low-sodium/low-fat items and produce. A partnership team was developed to achieve these objectives including academics, grassroots leaders, local business owners, the mayors of the two largest cities in the county, and the regional economic development officer.

The MOTMGC intervention used a variety of nutrition education activities based on DASH +sodium. Each activity was created with community and academic partners to ensure that the final nutrition recommendations and all related educational materials were culturally appropriate and used effective health education practices based on the social cognitive theory.¹⁹ Activities and materials focused on the REACH message (**R**each for larger portions of fruits and vegetables, **E**at less sodium/salt, **A**im to eat more fruits and vegetables every day, **C**hoose to season your vegetables with less fat, **H**unt for a variety of fruits and vegetables, using color as your guide), and were conducted by trained community health advocates. Educational messages also included messages about consuming lower-fat dairy and meats, and the importance of consuming whole grains. Specific goals were provided for each message; for example, suggesting that individuals eat <1 teaspoon of salt in a day by choosing foods that are lower in sodium, not adding salt, and paying attention to the sodium in condiments.²⁰ The academic and community partners worked together to create a REACH message series (one overview and one session focusing on each REACH component), family dinner nights (families cooked a REACH recipe at a local community organization), and taste testing at the MOTMGC produce stand, farmers market, and grocery stores. Approximately 1,200 individuals participated in one or more of these activities. Educational materials (recipes, tip sheets) were placed in local grocery stores, barber/beauty shops, churches, and clinic and hospital settings. A monthly newsletter was distributed at various local venues and printed in a local newspaper to share heart healthy messages and recipes.

Study Design and Sample

The MOTMGC study used a quasi-experimental cross-sectional design with a comparison county to evaluate the intervention. Surveys were conducted with African Americans aged 18 years in the intervention and comparison counties at baseline (2008) and again post-intervention (2013), with these analyses conducted in 2015. This design is considered appropriate when an aim is to change the prevalence of a particular behavior(s) in a community.²¹ The work was approved by the Saint Louis University IRB.

Pemiscot and Dunklin County were selected as intervention and comparison counties, respectively. Pemiscot County is a rural county located in southeast Missouri with a population of approximately 17,800, 26% of whom were African American.²² Approximately 55% of the African American population did not have a high school education/GED, and 56% lived below poverty.²² Dunklin County, adjacent to Pemiscot County, had approximately 31,700 residents, 10% of whom were African American.²³ Heart

disease mortality rate among African Americans within both these counties was significantly higher than the mortality rate in Missouri.²⁴

Survey participants were recruited from places frequented by African American adults in Pemiscot and Dunklin counties (e.g., community organizations, places of worship). The same recruitment methods were used at baseline and post intervention. Study participants in both the intervention and comparison counties provided informed consent, completed a self-administered survey, had their blood pressure measured, and were provided a \$15 incentive to complete the survey instrument.

Measures

Three questions from the Transtheoretical Model²⁵ measured self-reported behaviors. The question stems included: *Do you currently eat five or more servings of fruits and vegetables daily? Do you eat less salt than you did a year ago? Do you currently season your vegetables with less fat than you did a year ago?* Five response options measuring intent were provided from *Yes and I have done this for more than 6 months* to *No and I don't intend to change this within the next 6 months*. Examples of serving sizes were provided.

Survey administrators were trained by the local health department staff to collect blood pressure by digital sphygmomanometers.^{26,27} All participants had their blood pressure read twice, in a sitting position at the data collection site. Survey administrators were not aware of county of residence of the participant when they obtained the blood pressure reading. Respondents were coded as hypertensive if the average of two systolic blood pressure readings was ≥ 140 mmHg or the average diastolic blood pressure was ≥ 90 mmHg.²⁸

Participants' BMI (kg/m^2) was calculated from self-reported weight and height and categorized as normal weight (BMI=18.5–24.9), overweight (BMI=25.0–29.9), and obese (BMI=30.0) according to international standards.²⁹

Baseline and post-intervention surveys included a measure asking individuals if they were currently taking blood pressure medication (yes/no).

The post-intervention survey included six “yes” or “no” questions about the extent of participation in nutrition education activities. For example: *Did you attend a Men on the Move Growing Communities cooking demonstration?* A summary variable was created to categorize respondents into three participation levels based on the distribution of responses. Respondents were classified as “no participation” if none of the six activities were endorsed. Respondents were classified as “medium participation” if one activity was endorsed. Respondents were classified as “high participation” if two or more activities were endorsed.

Post-intervention survey respondents were asked: *Did you ever get fruits and/or vegetables from one of the Men on the Move Growing Communities' gardens or vegetable stands?*

The respondents were asked about perceived behavioral outcomes as a result of the gardens. The question stem was: *Because of the community gardens...* Perceived behavioral outcomes included eat more fruits and vegetables, eat more greens, and spend less money on

food. Using a 5-point Likert Scale, respondents were asked how much they agreed with each statement.

Behavioral Risk Factor Surveillance System questions captured self-reported age, gender, race, education status, and current employment.⁴⁹ Sociodemographic characteristics were used to statistically control for differences in study respondents between intervention and comparison counties.

Statistical Analysis

The purpose of the analyses was to assess the impact of the intervention on hypertension, BMI, and self-reported behavior change. Chi-square and *t*-tests were used to test differences between baseline and post-intervention outcomes. Linear regression was used to determine demographic, participation, and behavior predictors for BMI and hypertension. An interaction term in logistic regression was used to determine if changes in prevalence of hypertension and BMI between baseline and post-intervention differed between intervention and comparison counties (2 X 2 time by county). Sociodemographic characteristics were included in the models to calculate adjusted changes over time between counties. SAS, version 9.2 was used for all analyses. A *p*-value <0.05 was considered statistically significant, but 99% CIs are included in Tables 3 and 4 for comparative purposes.

Results

Table 1 provides demographic information for the intervention and comparison counties. Educational attainment was higher at baseline among survey respondents in the intervention county than the comparison county. At baseline and post-intervention, the intervention county had a lower percentage of households with incomes <\$10,000. Both counties had a higher percentage of households who earned <\$10,000 at post-post intervention compared with baseline. At baseline, intervention respondents were older than comparison respondents. In comparing the sample population to Census estimates, the study participants in the intervention and comparison county were younger (41.7 vs 46.5 years; 38.8 vs 43.1 years) and less likely to be male (37.3% vs 41.2%; 34.5% vs 43.8%).

There was a significant decline in the prevalence of overweight and obese respondents from baseline to post-intervention in the intervention county ($p<0.01$), but not the comparison county ($p=0.39$). The intervention county had significant reductions in the prevalence of hypertension ($p<0.01$), but not the comparison county ($p=0.48$) (Table 2).

Analyses indicated a significant difference in mean diastolic blood pressure ($p<0.01$) in the adjusted model, with a difference in the frequency between the baseline and post-intervention sample mean diastolic blood pressure in the intervention (pre, 84 mmHg; post, 80 mmHg) but not the comparison county (pre, 81 mmHg; post, 82 mmHg). The change in the mean systolic blood pressure was not significant ($p=0.09$), with decreases seen in the intervention (pre, 140 mmHg; post, 137 mmHg) but increases in the comparison county (pre, 138 mmHg; post, 140 mmHg). The analysis showed no significant difference between the percentage of individuals who were taking blood pressure medication at baseline and post-intervention ($p=0.12$).

Seventy-four percent of survey respondents took part in at least one form of nutrition education in the intervention county, relative to 24% of respondents in the comparison county. Forty-five percent of respondents from the intervention county accessed produce from the gardens versus 15% of respondents from the comparison county. Because comparison county residents reported participating in intervention activities, the analyses examined the effect of participation in nutrition education on self-reported vegetable consumption and access regardless of county.

Those with high participation in MOTMGC nutrition intervention activities self-reported that they eat five or more servings of fruits and vegetables a day (OR=1.46, 95% CI=1.00, 2.12), eat a greater variety of fruits and vegetables (OR=1.75, 95% CI=1.14, 2.71), eat less salt (OR=1.56, 95% CI=1.05, 2.31), and season their vegetables with less fat (OR=1.64, 95% CI=1.10, 2.45) than those who did not participate in any educational activities (Table 3). These effects remained after adjusting for age, education, employment, and income. Those who had high participation did not differ from those who did not participate in any educational activities with regard to eating larger portions of fruits and vegetables in either the unadjusted (OR=1.10, 95% CI=0.74, 1.63) or adjusted (OR=1.06, 95% CI=0.70, 1.61) models. Those with medium participation did not differ from those who did not participate in any educational activities for any of the self-reported consumption behaviors.

The survey respondents indicated that as a result of their access to MOTMGC gardens they were likely to eat more fruits and vegetables overall, and identified eating more of several specific items (Table 4). Respondents also indicated that as a result of the MOTMGC gardens they ate more locally grown food, new kinds of food, and foods that are traditional to their culture. In addition, they reported eating less processed food and fast food. They indicated they spent less money on food and were better able to provide food for their families/themselves.

Level of participation was not associated with average systolic blood pressure in unadjusted analysis ($p=0.7211$) or adjusted analysis ($p=0.8881$). Level of participation was also not associated with average diastolic blood pressure in unadjusted analysis ($p=0.7228$) or adjusted analysis ($p=0.8620$). Similarly, there was also no interaction between “currently eating less salt” and hypertension at Year 5 in unadjusted analysis ($p=0.36.83$) or adjusted analysis ($p=0.5359$).

Discussion

Findings indicate that adapting the DASH diet to community settings through culturally appropriate community-based efforts can alter intake of fruits, vegetables, sodium, and fat, and can lower the community prevalence of obesity and high blood pressure. DASH clinical trials demonstrated a mean decrease of 5.5 mmHg in systolic blood pressure and 3.0 mmHg in diastolic blood pressure.⁸ Participants in MOTMGC who reported “high participation” self-reported that they consumed more fruits and vegetables, seasoned their food with less sodium, and used less fat. There was a significant difference between the baseline and post-intervention samples in the intervention county of 4 mmHg in systolic and 2 mmHg in diastolic blood pressure, but not in the comparison county.

Limitations

There are several limitations to this work. In terms of design, a cross-sectional design was used to assess the impact of MOTMGC interventions. Although appropriate when using a community-based intervention and given concerns about attrition using a longitudinal design, not measuring the same individuals at both times may have provided less power and limited the ability to assess causality between dietary changes and blood pressure changes.²¹ Post-intervention respondents also differed in terms of income and age compared with pre-intervention respondents. This is unlikely to have biased the findings because this was similar across both counties. A further limitation is that although the MOTMGC comparison community was chosen based on the similarity of historic, racial, cultural, and general contextual factors, it was adjacent to the intervention community. Some contamination may have occurred but it was not possible to assess the degree to which this may have affected results. Other than blood pressure, assessments were self-reported (including height and weight). Though this may have biased the information that was received, all respondents were asked the questions similarly, so it likely did not influence differences between counties or among those who had different levels of participation. A related limitation is that participants were not asked if they worked in the garden, which may have influenced subsequent behavior.

Though the analyses controlled for several determinants, it is possible that the changes in the intervention county but not the comparison county were due to circumstances outside of intervention activities. One such potential confounder is access to care. However, county-level data indicate that the comparison county had higher access to care (clinical care available) than the intervention county, suggesting that access to care is unlikely to explain the findings.²³ Further, among those currently with high blood pressure, there was no significant difference between those taking blood pressure medications at baseline and post-intervention.

Conclusions

It is critical to develop interventions to address the disparities in African American morbidity and mortality caused by high blood pressure and cardiovascular diseases. DASH +sodium diets have been shown to be effective in reducing blood pressure in clinical settings and when food has been provided to the study participants. MOTMGC is among the first to translate the DASH+sodium dietary recommendations from a clinical setting into a community setting.³⁰ Using a community-based participatory approach with community health advocates providing culturally appropriate nutrition education based on the DASH +sodium diet and collaboration with local businesses to increase access to fruits and vegetables and low-fat and low-sodium foods led to changes in self-reported behavioral change for those with higher participation in MOTMGC activities than those with no participation. This is consistent with previous work that indicates that if clinical trials are to be translated to community settings it is critical to do so in ways that take into account the cultural and contextual aspects of the community.^{30,31}

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Characteristics of African Americans Residents at Baseline and Post Intervention by County

Table 1

Variable	Baseline			Post intervention		
	Pemiscot (Intervention)	Dunklin (Comparison)	p- value	Pemiscot (Intervention)	Dunklin (Comparison)	p- value
	Baseline (n=397) %	Baseline (n=397) %		Post (n=395) %	Post (n=391) %	
Gender						
Male	37.3	34.5	0.26	36.0	32.5	0.35
Female	62.7	65.0		63.8	67.5	
Missing	0.0	0.5		0.3	0.0	
Age	41.7 (14.7)	38.8 (14.6)*	0.01	38.6 (15.7)	39.4 (14.8)	0.45
Annual household income						0.01
Mean (SD)	31.0	35.8*	<0.01	42.3	45.3	
\$0-\$9,999	17.4	16.2		15.2	15.1	
\$10,000–14,999	10.3	7.7		9.9	8.7	
\$15,000–19,999	5.3	3.7		4.6	2.8	
\$20,000–24,999	6.8	1.9		5.1	2.8	
\$25,000–34,999	3.8	1.9		1.8	0.8	
\$35,000–49,999	2.0	0.3		1.3	0.0	
\$50,000–74,999	2.0	0.0		2.0	0.8	
\$75,000 or more	21.4	32.6		18.0	23.8	
Missing	21.4	19.1		29.1	19.2	0.01
Perceived income adequacy			0.11			
Comfortable	44.6	47.5		38.7	44.3	
Have just enough	33.8	31.6		31.9	36.6	
Do not have enough	0.3	1.9		0.3	0.0	
Missing	1.3	0.8*	0.01	1.0	0.5	0.05
Education						
Never attended school	5.5	6.6		5.1	4.6	
grades 1–8	24.9	34.0		21.8	28.6	
grades 9–11	46.6	46.4		48.6	51.2	
grades 12 or GED	14.6	10.3		18.2	12.3	
college 1–3 years	5.8	1.1		3.8	2.6	
college 4 yrs or more	1.3	0.8		1.5	0.3	
Don't know						

Note: Boldface indicates statistical significance ($p < 0.05$).

GED, General Educational Development test

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Table 2

Prevalence of Hypertension, Overweight, and Obesity for the Intervention and Comparison Counties at Baseline and Post Intervention

	Intervention county		Comparison county	
	Baseline	Post intervention	Baseline	Post intervention
Hypertensive (%) ^a	61.0	43.5	46.7	49.1
Overweight or obese	69.8	62.8	65.2	66
Overweight	28.7	29.4	30.1	25.8
Obese	41.1	33.4	35.1	40.2

^aHypertensive (%) Respondents were coded as hypertensive if the average of two systolic blood pressure readings was 140 or higher or the average diastolic blood pressure was 90 or higher.

Note: Boldface indicates statistical significance ($p < 0.05$).

Prevalence of Self-Reported Behavioral Change and the Effect of Participating in Nutrition Education, Year 5 (N=801)

Table 3

Behavior ^a	Prevalence (%)	Unadjusted (OR, 95%; 99% CI)			Adjusted for sociodemographics ^b (OR, 95%; 99%CI)		
		High participation	Medium participation		High participation	Medium participation	
Currently eat 5 or more servings of fruits and vegetables daily	46.2	1.46 (1.00–2.12; 0.89–2.38)	1.34 (0.95–1.88; 0.86–2.09)		1.51 (1.03–2.22; 0.91–2.51)	1.34 (0.94–1.90; 0.94–1.90)	
Currently eat larger portions of vegetables	62.6	1.10 (0.74–1.63; 0.65–1.85)	0.63 (0.45–0.89; 0.40–1.00)		1.06 (0.70–1.61; 0.61–1.84)	0.63 (0.44–0.91; 0.39–1.02)	
Currently eat greater variety of fruits/vegetables	67.0	1.75 (1.14–2.71; 0.99–3.10)	0.88 (0.62–1.24; 0.55–1.39)		1.65 (1.06–2.58; 0.92–2.97)	0.86 (0.60–1.24; 0.53–1.39)	
Currently eat less salt (sodium) than you did a year ago	41.9	1.56 (1.05–2.31; 0.93–2.61)	0.88 (0.63–1.24; 0.57–1.38)		1.56 (1.03–2.37; 0.91–2.70)	0.94 (0.65–1.35; 0.58–1.51)	
Currently season your vegetables with less fat than you did a year ago	61.1	1.64 (1.10–2.45; 0.97–2.77)	1.14 (0.81–1.61; 0.73–1.79)		1.58 (1.04–2.40; 0.91–2.73)	1.17 (0.81–1.69; 0.72–1.90)	

^aBehavior: Comparing the combined 'Yes' ['Yes and I have done this for more than 6 months' and 'Yes and I started doing this during the last 6 months'] with combined 'No' ['No but I intend to change this within the next month,' 'No but I intend to change within the next 6 months, and 'No and I don't intend to change this within the next 6 months'].

^bAdjusted for sociodemographic variables (age, education, employment, and income)

Table 4
Association Between Nutritional Behavior and Having Received Fruits and/or Vegetables From the MOTMGC Gardens, Year 5

Behavior	Prevalence (%)	Unadjusted (OR, 95% CI)	Adjusted (OR, 95% CI) ^a	Unadjusted (OR, 99% CI)	Adjusted (OR, 99% CI) ^b
Eat more fruits and vegetables	47.8	2.97 (2.01–4.38)	3.36 (2.22–5.08)	2.97 (1.78–4.95)	3.36 (1.95–5.78)
Eat more greens	43.3	3.39 (2.30–5.01)	3.55 (2.35–5.35)	3.39 (2.03–5.66)	3.55 (2.07–6.09)
Eat more tomatoes	35.5	2.75 (1.92–3.93)	2.56 (1.76–3.71)	2.75 (1.72–4.39)	2.56 (1.57–4.18)
Eat more apples	40.3	1.61 (1.14–2.30)	1.79 (1.23–2.60)	1.61 (1.02–2.56)	1.79 (1.10–2.93)
Eat more watermelon	39.1	2.29 (1.59–3.29)	2.54 (1.73–3.73)	2.29 (1.42–3.69)	2.54 (1.54–4.20)
Eat more okra	30.3	2.90 (2.02–4.15)	2.81 (1.94–4.09)	2.90 (1.81–4.65)	2.81 (1.72–4.59)
Eat more peas	29.7	3.06 (2.13–4.38)	2.88 (1.98–4.19)	3.06 (1.90–4.91)	2.88 (1.76–4.72)
Eat more locally grown food	32.5	3.55 (2.45–5.13)	3.29 (2.25–4.83)	3.55 (2.19–5.76)	3.29 (1.99–5.44)
Eat less processed food	30.1	2.69 (1.88–3.86)	2.52 (1.73–3.67)	2.69 (1.68–4.33)	2.52 (1.54–4.13)
Eat less fast food	33.8	2.06 (1.45–2.94)	2.05 (1.42–2.95)	2.06 (1.30–3.28)	2.05 (1.26–3.31)
Spend less money on food	27.6	2.27 (1.59–3.24)	2.31 (1.60–3.34)	2.27 (1.42–3.62)	2.31 (1.42–3.76)
Am better able to provide food for my family and myself	43.7	2.72 (1.87–3.97)	2.92 (1.96–4.34)	2.72 (1.66–4.47)	2.92 (1.73–4.92)

^aBehavior: Stem read 'Because of MOTMGC, I ...' Comparing (strongly) agree with (strongly) disagree

^bAdjusted for sociodemographic variables (age, education, employment, and income), MOTMGC, Men on the Move Growing Communities