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Weight loss outcomes from a pilot study of African Dance in older African Americans

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Abstract

Objective: Obesity is a risk factor for both cognitive and physical impairment in late adulthood. Though the rates of obesity are high in many groups, older African Americans are disproportionately affected. Here, we conducted a randomized pilot intervention of African Dance with 28 African American older adults with obesity (Mean age = 68.4 ±5.1 years; Mean BMI = 33.4 ± 6.2). The goal of the study was to evaluate the physiological outcomes of a culturally sensitive exercise intervention, and specifically changes in weight.

Methods: Participants were randomly assigned to an African Dance (experimental) or Culture Education (control) group. They attended their assigned class for 1-hour per session, 3 days per week, for 6 months.

Results: There was a significant Group x Time interaction on weight ($p = .005$), such that the African Dance group lost weight ($M = 4.0 \pm 6.0$ lbs.), while the Culture Education group gained weight ($M = 2.6 \pm 3.9$ lbs.).

Conclusions: These results suggest that a culturally-sensitive form of physical activity, African Dance, may be effective for promoting weight loss in a population at increased risk for obesity and cognitive decline.

Keywords

African Dance; Physical activity; Exercise; Weight loss

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Introduction

Obesity is linked to a host of negative conditions, including diabetes, heart disease, and dementia (1). Unfortunately, obesity is a growing problem in the United States and in many countries around the world. The rate of obesity amongst older adults between the ages of 65 and 75 is the fastest growing in the country (2). Nearly 50% of African American older adults, especially older African American females, qualify as obese (2). Specifically, 48.5% of African Americans over the age of 60 have obesity compared to 34.0% of whites, 42.9% of Hispanics and 8.9% of Asians of similar age (2). Thus, older African Americans are at especially high risk for obesity. The higher risk for obesity in African American communities is likely related to a number of factors including inequities in income, access to stable and affordable housing, access to quality education, healthy foods or safe places to be physically active (2).

Fortunately, there is increasing evidence supporting the effectiveness of physical activity (PA) for weight management. However, African Americans report lower levels of PA compared to other racial and ethnic groups as well as higher rates of sedentary behavior (3). This difference in activity levels has also been measured objectively; using accelerometry, for example, both African American men and women engage in less PA and greater amounts of sedentary behavior than their white counterparts (4). As with obesity trends, there are likely many environmental variables contributing to these PA behavioral trends, including differences in community walkability and access to health education and resources. Regardless of the root cause for these statistics, the comparatively low-PA and high-sedentary lifestyles of African Americans compared to whites puts this group at an increased risk for obesity and a host of other conditions, including diabetes, hypertension, heart disease, and dementia (5,6).

Given the above statistics and health patterns, there is a clear need to find effective ways to get older adults (not just African Americans) to engage in more PA. Dance is a common and enjoyable form of PA for older adults and has been shown to be effective at increasing PA and improving physical fitness (7–10). In addition, prior studies have identified that African American participation in research is far more likely if the activity is exciting, culturally relevant, spiritual, and conducted in a social format (11). Our choice to conduct an African Dance intervention in a group format at accessible centers around the Pittsburgh African American community met all of these criteria in order to maximize engagement. Here, our primary purpose was to examine how the intervention affected physiological variables, particularly weight status.

Methods

Participants

One hundred twenty-three participants were screened by phone by study staff at two urban sites (located at the University of Pittsburgh in Pittsburgh and University of Pennsylvania in Philadelphia). The majority of participants were recruited via flyers placed at community centers and churches. Participants were told they were being recruited to study the effects of different group activities on quality of life and cognition in older African Americans. In

order to be eligible for the intervention, participants were required to 1) self-identify as African American, 2) be between the ages of 60 and 80, 3) be physically capable of PA and be independently ambulatory without assistive walking devices, 4) score at least a 21 on the Telephone Interview for Cognitive Status (TICS) to rule out dementia, 5) verify that they reside locally and are available to make the sessions during the entire length of the intervention (6months), and 6) indicate a willingness to being randomly assigned to either the Dance or Culture Education group. Two cohorts of participants were randomized at the Pittsburgh site (28 total, 15 Dance, 2 male). Two additional cohorts were randomized at the Philadelphia site (26 total, 13 Dance, 8 male). Participants completed two testing sessions at each time point (baseline and follow-up). The first was a cognitive testing session in which participants completed cognitive tasks and questionnaires. The second was a fitness session in which participants completed a submaximal graded exercise test on a treadmill. The exercise test was conducted using a modified Balke protocol at a self-selected, brisk walking pace by the participant. Treadmill grade increased by 1% every minute, while speed remained constant. The test was terminated when one of the following criteria was met: 1) participant achieved 85% of their age-predicted maximal heart rate (220-age), 2) participants prescribed beta-blockers reported a Rating of Perceived Exertion of 15 (Borg 6–20 scale), 3) participant requested to stop, or 4) safety concerns. In order to be deemed eligible for the study, participants must have met criteria 1 or 2. Those who were unable to complete the submaximal exercise test were ineligible for the study in order to minimize safety risks associated with the intervention.

Height and weight were measured by trained exercise physiologists during the fitness session using a Pelstar Health-O-Meter Professional stadiometer and digital scale (Model: 500KL) that undergoes monthly calibration checks. Participants' shoes and any heaving clothing were removed before measuring both height and weight.

Primary outcomes of the pilot trial included cognition, mood, quality of life, and fitness. The Pittsburgh site also added a secondary outcome of weight and Body Mass Index (BMI) given the prevalence of obesity in older African Americans. These additional physiological measures were collected during the fitness testing session which took place separately from the cognitive testing session at both time points. As weight/BMI status was not a primary outcome of the parent pilot trial, however, the Philadelphia site did not measure height and weight objectively using a stadiometer and calibrated scale. We therefore focus on the objective weight, from the Pittsburgh site in the present analyses.

After completion of the baseline sessions, participants were randomly assigned to either the African Dance (experimental) or Culture Education (control) group. All classes took place at a local community center located proximally to several predominately African American neighborhoods in Pittsburgh, PA. As with the baseline sessions, the specifics of the Dance and Education intervention groups have been described previously (12). However, the general structure of each group's activities are summarized briefly below. Six months after their enrollment, participants came back into the lab for follow-up assessments. Informed consent was obtained for all participants prior to any testing in accordance with the Declaration of Helsinki. All procedures were reviewed and approved by the University of Pittsburgh Institutional Review Board.

African Dance Intervention

African Dance refers to a loose constellation of dance practices derived from Africa. African dance differs from almost all other forms of dance in one primary way. Whereas in the majority of dancing around the world the body is treated as a single "block," in African dance the body has multiple, semi-independent centers. In African dance, the torso, shoulders, pelvis, and legs are relatively independent – each region of the body follows a different rhythm and gestural pattern. Because of African dance's "polycentricity", total body articulation is heightened and therefore requires significant movement, coordination, and endurance. Hence, African Dance is engaging while also being a moderately intense form of PA (13) .

For the Rhythm, Experience and Africana Culture (REACT!) trial, we drew on music and dance styles from Guinea and Uganda (e.g., *Djole and Amaggunju*). Both styles are relatively vigorous because they involve high- and mid-range jumps, coupled with complex choreography that engages the entire body. REACT! dance instructors modified some of the moves of the traditional dance motifs in order to better suit older adults. However, this did not compromise the vigor and intensity of the dances.

The African Dance group was conducted in a group format and adhered to basic principles and guidelines for exercise programming (14). This included adequate warm-up and cool-down, progressive and gradual increments in duration, and instruction regarding avoidance of physical activity-related injury. Classes were taught by trained African Dance instructors and research coordinators were also present for all sessions to monitor heart rate, exertion, and safety. The African Dance group received moderate-intensity dance instruction for 1 hour per day (including warm-up and cool-down), 3 days per week, for 24 weeks. Throughout the class, study dance staff played live music on African drums (called *djembe*). Specific tempi were selected to guide intensity. For example, during warm ups, *moderato* (a moderate tempo of about 108–112 beats per minute (bpm), was employed. For the majority of the session, three versions of tempi: *Andante* (a walking pace tempo of 78–107 bpm), *Moderato* and *Allegro* (a fast tempo of 120–150 bpm) were employed. Moderate-intensity was defined as 60–75% of age-predicted maximal heart rate (APMHR) and each participant was encouraged by study staff to either increase or decrease intensity to remain within their specific range. In addition, the tempi of the music were modified (between the three tempi mentioned above) based on the average class heart rate in order to keep participants within the target range. In order to monitor heart rate, participants were fitted with a Polar H7 Bluetooth Smart heart rate sensor to be worn on their chest throughout the duration of each class. Continuous heart rate readings of all participants were displayed in real-time via the Polar Team app (Version: 1.0) on an iPad Air (Model: A1474, iOS 9) allowing staff to monitor adherence and safety. Attendance was taken at each class.

Culture Education Intervention

The Culture Education control group was also conducted in a group format. Participants received materials focused on precolonial, colonial and postcolonial Africana history and culture, spirituality, ethnicity, language, social organization, rites of passage, and political structure. Participants were also instructed about healthy lifestyles, behaviors, and risks for

disease. Topics varied from session to session to maintain engagement and to align with group interest. As with the African Dance group, the Culture Education group met 1-hour per day, 3 days per week, for 24 weeks, with attendance taken at each session. Culture Education classes were led by instructors with expertise in each particular topic area.

Analyses Approach

First, a series of independent samples *t*-tests were conducted to assess whether the groups differed in any demographic or fitness variables at baseline. Next, in order to compare the effectiveness of the African Dance intervention compared to the Culture Education control on weight, an ANOVA F-test using mixed models with normally distributed random effects for participants was conducted in which Time (baseline, follow-up) was the repeated measures factor and Group (Dance, Culture Education) was the between-subjects factor. Changes in fitness over the intervention were also examined between the groups via an ANOVA F-test (again, using mixed models with normally distributed random effects) with peak VO_2 from a submaximal treadmill test as the dependent variable. All hypothesis tests were conducted at the significance level of .05.

Results

Twenty-eight participants were randomized at the Pittsburgh site (13 Culture Education, 15 Dance). Of these, 4 participants failed to return for follow-up testing. Thus, these analyses are based on a final sample of 24 participants (11 Culture Education, 13 Dance). Average attendance to the classes was 54% but varied substantially across participants (SD = 32%). Twelve of the 13 (92.3%) dance class participants who returned for follow-up maintained a heart rate that was within the moderate-intensity range (60–75% of APMHR), on average, during their attended classes. Only one of these 13 participants average heart rate was below the targeted range.

Demographic information, including age, baseline fitness levels, and body mass index (BMI) for each group is presented in Table 1. Independent samples t-tests revealed no differences in any of these variables across the intervention and control groups at baseline, *t*s < 1.7, *p*s >. 10. Notably, as shown in Table 1 the average BMI of both groups was within the obese range (full sample average BMI = 33.37 ± 6.43).

There was a significant Group x Time interaction on weight, $F(1, 22) = 9.69$, $p = .005$. This was a small to moderate sized effect (partial Eta Squared = .31). Pairwise *t*-tests revealed that this interaction was driven by a significant decrease in weight for the Dance group, $t(12) = 2.38$, $p = .03$, and a marginal increase in weight for the Culture Education group, $t(10) = -2.22$, $p = .05$. The mean weight for each group, at each time point are shown in Table 2. This same pattern of results was also observed for BMI (i.e., since participants' height remained stable across the longitudinal assessments).

There was not a significant Group x Time interaction effect on fitness, $F(1,22) < .001$, $p = .988$. On average, both groups' peak VO_2 increased, although neither of these improvements were statistically significant (*t*s < .66, *p*s > .52). Mean changes in fitness by group can also be found in Table 2.

Given the significant change in weight in the dance group, Pearson correlations were conducted to determine whether weight change (pre – post intervention weight) was correlated with intervention attendance, adherence (i.e., average heart rate during attended sessions), or changes in fitness within the dance group. None of these factors were significantly correlated with weight change (rs < .26, ps > .35)

Discussion

After a 6-month African Dance intervention for older African American adults with obesity, weight loss was observed. This is in contrast to the Culture Education control group, which showed a marginal increase in weight during this time. These results are important as they suggest that African Dance at a moderate-intensity level is an engaging activity that may be an effective approach for promoting weight loss in older African Americans, even without concurrent changes in fitness.

African American older adults are at increased risk for obesity and associated health issues compared to other racial and ethnic groups. Yet, African Americans are more likely than their white counterparts to become increasingly sedentary as they age (4,15). Despite variability in attendance in our intervention, compliance to a moderate-intensity heart rate level during the session was high, suggesting that dance intensity may be the critical factor related to weight loss over a 6-month period. Only one participant in the Dance group failed to maintain an average heart rate in the target range, although it is important to note that this participant was prescribed a beta-adrenergic antagonist. These medications are known to reduce heart rate both at rest and during exercise, thus limiting the ability to reach the target heart rate zone (16).

Supporting the importance of the intensity of physical activity, the relationship between weight change and average dance class heart rate was stronger in our sample than that between weight change and dance class attendance, although neither correlation was statistically significant. In fact, the precise dose of PA necessary to maximize health benefits is still widely debated and likely depends on the health outcome in question. PA is considered to be more effective for weight *maintenance,* rather than weight loss, but many PA interventions have been able to demonstrate modest weight loss in sedentary individuals (17). Although there is evidence of weight loss following interventions that increase PA behaviors, there are many other factors outside of the PA intervention that affect weight (such as dietary behaviors, discussed below). More research is needed to better establish the nature of the relationships between frequency, intensity, and dosage of PA in diverse populations. It is possible, for example, that physical activities, such as dance, are more effective at promoting weight loss in populations at particularly high risk for obesity.

Another interesting aspect of these results is that weight loss was observed even despite the fact that no dietary advice or oversight was provided. Diet is considered to be the primary factor affecting weight loss (18,19), while PA may be more beneficial for weight maintenance. Yet, in this sample with obesity, increasing PA alone significantly affected weight. Of course, given that we provided no dietary monitoring, it is impossible to determine whether the participants either implicitly or explicitly changed their eating habits

outside of the intervention. Nonetheless, these results are promising in that they suggest that even incremental changes in lifestyle behaviors, such as PA, may be effective for promoting weight loss. Future work should more closely monitor behaviors external to the intervention, such as diet and PA levels, to examine if changes in energy intake or energy expenditure could potentially explain changes in body weight.

Finally, weight loss in the Dance group was observed, even in the absence of a significant increase in fitness in the Dance group. One possible explanation for this, although purely speculative based on this pilot study, is that exercise may have effects on satiety hormone signaling involved in hunger and feeding behaviors, perhaps suppressing appetite. It has been demonstrated, for example, that acute bouts of exercise can result in increased levels of certain gastrointestinal peptides, such as ghrelin, polypeptide (PYY), glucagon-like peptide1 (GLP-1), and pancreatic polypeptide (PP) – all of which are known to regulate appetite (20). Thus, while the intervention may not have been of the intensity necessary for changing fitness, it might nonetheless have had effects on weight via satiety-signaling-related mechanisms. Future work will include assessment of circulating metabolites (i.e., from blood draws) in order to test this hypothesis.

There are several limitations to our initial study on this pertinent public-health topic of health disparities in PA and obesity risk. First, our sample size was quite small and it was made even smaller because several subjects did not return for follow-up testing. Another limitation is that we did not collect comprehensive physiological measurements on the participants such as body fat, muscle mass, etc. Thus, it is difficult to determine whether the decreases in weight we observed in the Dance group are clinically significant. Finally, we did not measure or assess physical activity levels of participants outside of the intervention, and so it is unclear whether the changes in fitness observed in the Culture Education group were the result of unanticipated changes in PA behavior outside of the study. It is also unclear whether the Dance group increased PA levels outside of the intervention, which may explain why weight loss was observed despite attendance being lower than many traditional PA interventions (e.g., those involving aerobic walking). Future studies will need to assess whether weight changes following a PA intervention are correlated with any physiological or neurocognitive changes, and better track PA outside of the intervention, in order to better interpret these results.

Despite these limitations, we can draw some broad conclusions from these data. Engaging in a six-month PA program, specifically, African dance, may be a viable option to promote weight loss in older, African-American adults with obesity. Participating in an African dance class may therefore be an alternate mode of physical activity for older adults with obesity when attempting to lose weight. It is important that future interventions include a larger sample, as well as more physiological and lifestyle measures, to explore in greater detail the efficacy of an African dance PA program on both physical, brain, and mental health of older adults.

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Study Importance Questions:

1. What is already known about this subject?

- African American women and men have the highest rate of obesity amongst all ethnic groups.
- Exercise interventions are effective at promoting aspects of physical health, including weight maintenance. However, African Americans have been poorly represented in the lifestyle intervention literature to date.

2. What does this study add?

- Here, we report significant weight loss following a pilot intervention of a culturally sensitive form of exercise, African Dance, in older African American adults with obesity.
- We demonstrate that a culturally-sensitive form of physical activity, African Dance, can effectively promote weight loss in an African American sample, even without changes in cardiorespiratory fitness.

Table 1.

Baseline demographic characteristics of study participants who returned for follow-up testing. Data are presented as mean (Standard Deviation); Range. Abbreviations: Mini Mental State Examination (MMSE); Body Mass Index (BMI).

	Dance (SD); Range (n = 13)	**Education (SD); Range (n = 11)**	***P*-value**
Age (years)	67.9 (4.8); 62–75	68.8 (5.8); 60–78	0.655
Education (years)	15.6 (2.8); 12–20	16.0 (3.1); 12–22	0.754
MMSE score	29.0 (1.4); 26–30	29.3 (1.0); 27–30	0.588
Distance to site (miles)	6.0 (3.2); 1.4–10.2	5.1 (4.3); 1.5–13.7	0.576
Peak VO_2 (ml/kg/min)	14.3 (2.8); 10.6–21.1	12.3 (2.9); 6.4–16.7	0.103
Weight (lbs)	197.1 (45.0); 126.6–271.5	184.0 (42.3); 108.4–236.4	0.473
BMI (kg/m^2)	34.0 (6.9); 23.9–46.6	32.6 (6.1); 23.1–43.7	0.607
Class Attendance (%)	51 (34); 4–94	58 (30); 0–96	0.600

Table 2.

Change in weight and fitness by group assignment over the 6-month intervention as assessed via mixed effect ANOVAs. The Group x Time interaction for weight was significant (p=.005 from ANOVA F-test).

	Dance (SD) (n=13)	Education (SD) (n=11)
Weight (lbs.) Baseline	197.1 (45.0)	184.0 (42.3)
Follow-up	193.1 (42.2)	186.6 (42.4)
Change	**−4.0 (6.0)** *	2.6 (3.9) ±
P-value	0.035	0.051
Peak VO_2 (ml/kg/min) Baseline	14.3 (2.8)	12.3 (2.9)
Follow-up	14.7 (3.7)	12.7 (2.8)
Change	0.4 (2.3)	0.4 (2.6)
P-value	0.524	0.590

Data are presented as mean (SD).

* Bold denotes a significant effect

± denotes a marginal effect.

The p values presented within the table are from pairwise t-tests.