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# Mediating Effects of Group Cohesion on Physical Activity and Diet in Women of Color: Health Is Power

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## Abstract

**Purpose—**To determine the effects and mediating factors of a physical activity (PA) or vegetable and fruit (VF) group cohesion intervention.

**Design—**Longitudinal design.

**Setting—**Harris County and Travis County, Texas.

**Participants—**Community-dwelling African-American and Hispanic or Latina women.

**Intervention—**Three hundred ten women were randomized to a PA (n = 204) or VF (n = 106) intervention group. Women met in groups six times over the course of 6 months and were exposed to a group cohesion intervention to promote walking or to increase VF consumption.

**Measures—**Women completed the International PA Questionnaire, National Cancer Institute VF and fat screeners, PA Group Environment Questionnaire, and 7-day accelerometer protocol at baseline and post-intervention.

**Analyses—**The direct and mediated effects of the intervention on outcomes were evaluated using a mediational chain model, controlling for baseline values and covariates using path analysis.

**Results—**Women were middle aged (mean = 44.4 years) and overweight or obese (mean body mass index = 34.0 kg/m$^2$). PA increased and fat consumption decreased for both groups, whereas VF consumption increased for women in VF group only (all $p < .05$). Increased task cohesion led to hypothesized increases in psychosocial factors in the PA group but not to behavioral changes.

**Conclusions—**Group cohesion interventions may have psychological and physical health benefits for African-American and Hispanic or Latina women, but refinement of measures and intervention delivery is needed to determine whether hypothesized mediational pathways are valid.



### Keywords

Physical Activity; Dietary Habits; Minority Health; Women; Group Cohesion


## PURPOSE

The combination of physical inactivity and poor dietary habits is rated as a top actual cause of death in the United States.[1,2] Both physical inactivity and poor dietary habits increase the risk of obesity and other health-compromising conditions, such as cardiovascular diseases, type 2 diabetes, and numerous cancers.[3–7] Women of color report some of the highest rates of physical inactivity (41% of African-American women and 45.7% of Hispanic women).[8] African-American and Hispanic women report a significantly lower prevalence of eating vegetables and fruit five or more times per day and doing regular physical activity compared with non-Hispanic whites.[9,10]

Despite these distressing statistics, there have been few innovative, theoretically guided interventions to increase physical activity and improve dietary habits in African-American and Hispanic or Latina women. Effective intervention strategies and outcomes are less clear

and not consistent[11]; even in effective interventions, the improved health habits are typically modest, are inconsistent, and decline rapidly.[12–14] Inconsistencies in this work point to a need for innovative strategies with a better understanding of the mechanisms of behavior change.

Group cohesion involves affiliation with a group that is based on shared affinity and goals and is defined as the participants' perceptions of individual attractions to the group task (ATGT), individual attractions to the group social (ATGS), group integration task (GIT), and group integration social (GIS).[15,16] Group cohesion is operationalized along social and task dimensions.[17,18] Group cohesion interventions have gained in popularity for increasing physical activity and may achieve high and sustainable participation in the long term.[17,19] Physical activity interventions that are based on group dynamics principles have been shown to enhance cohesion, reduce dropouts, and increase participation rates.[17,19,20] These interventions also achieved very high initial participation rates, with a mean participation rate greater than 80%.[20] Intervention strategies focused on developing social cohesion, such as clarifying individual roles, developing a group name, and wearing distinct apparel (e.g., group t-shirts, visors), and task cohesion, such as setting shared goals and group problem solving, lead to a positive and distinct group environment resulting in increased group cohesion.

In group dynamics theory, group goal setting is pivotal in enhancing motivation to engage in group-related behaviors. Group goal setting facilitates adherence to specific behavioral norms (e.g., A team goal to walk a certain distance motivates individuals to do their share to achieve the collective outcome). Developing individual roles or goals for behavior that will assist in attaining the collective goal increases individual identifiability and eliminates social loafing. Generation of specific group goals and norms, along with individual roles within the group, contributes to the development and sustainability of a group's structure and productivity. Although group cohesion interventions show promise, little empirical work has been done to document and describe the underlying psychosocial mechanisms that group cohesion interventions use to change behavior, and almost no work has been done outside the realm of physical activity or in populations of color.

The purposes of this study were (1) to determine the effects of a group cohesion-based physical activity or dietary habits intervention on walking and fruit and vegetable consumption, respectively, and (2) to determine whether the effect of the group cohesion intervention on physical activity or dietary habits was mediated by changes in group social or task cohesion and associated changes in social support, self-efficacy, or motivational readiness. It was hypothesized that a group cohesion-based physical activity or dietary habits intervention would increase physical activity and/or dietary habits and that increases in physical activity and dietary habits would be mediated by changes in psychosocial factors related to physical activity and diet.

# METHODS

## Design and Setting

Health Is Power (HIP) was a multi-site, longitudinal, community-based, randomized, controlled trial to increase physical activity and improve dietary habits in African-American and Hispanic or Latina women in Houston and Austin, Texas. The HIP study was conducted in 10 cohorts, year round between June 2006 and July 2008. Participants were randomly assigned to a physical activity group or vegetable and fruit comparison group. All HIP study assessments, measures, and procedures were approved by the Committee for the Protection of Human Subjects at the University of Houston, and participants provided written informed consent to participate.

## Participants

This study focused on ethnic minority women because of their increased vulnerability to chronic health conditions, such as heart disease and cancer, and their underrepresentation in the literature. Women were recruited to HIP via the media, brochures, churches, and internet communication over the course of 1 year. Interested participants were invited to call the HIP project and complete a telephone screening. Women were screened to meet the following inclusionary criteria: (1) self-identified as African-American or Hispanic or Latina, (2) between the ages of 25 and 60 years old, to include adults outside the college age range, (3) able to read, speak, and write in English or Spanish, (4) not pregnant or planning to become pregnant within the next 12 months, (5) a Harris or Travis County resident, (6) not planning on moving in the next 12 months, (7) physically inactive or doing less than 30 minutes of physical activity per day on 3 or more days per week, (8) free from medical illness or current medication that would be aggravated by participation in moderate intensity physical activity, (9) willing to be randomly assigned to either a physical activity group or a vegetable and fruit group, and (10) available between 5:30 and 8:00 P.M. on meeting dates. Women who did not meet criteria number 8 were allowed to enroll if they obtained a medical waiver from their physician stating they were able to participate in the HIP project under the physician’s supervision. Those who did not meet one or more of the screening criteria, excluding criteria 8 pending a waiver, were excluded from this study.

Women who met inclusionary criteria were invited to the baseline time 1 (T1) health assessment. Four hundred ten community dwelling, African-American and Hispanic or Latina women (n = 311 in Houston, and n = 99 in Austin) were assessed at T1. Of those assessed in Houston, 84.6% identified as African-American, and 15.4% identified as Hispanic or Latina; all participants in Austin identified as Hispanic or Latina.

Three hundred ten women, of the initial 410 assessed, returned 2 weeks later to the randomization session of the project and were randomly assigned to a physical activity (n = 204) or vegetable and fruit (n = 106) group using a weighted, computer-generated randomization procedure to produce an adequately powered sample to detect changes in the physical activity group; investigators and participants were blind to intervention condition during the randomization procedure. We completed six African-American and one Hispanic or Latina cohorts in Houston and three Hispanic or Latina cohorts in Austin. Of those

randomly assigned to a group, 202 participants were African-American, and 108 were Hispanic or Latina. Nearly 200 (n = 188) women returned to complete a post-intervention (T2) assessment 6 months later.

## Assessments

Health assessments were an interviewer-administered questionnaire, including measures of socioeconomic status, physical activity, dietary habits, and group cohesion, and physical measures of resting heart rate, blood pressure, body mass index (BMI; $kg/m^2$) and percent body fat. Women who completed the T1 assessment (n = 410) were enrolled in the study and given a take home packet. The take home packet contained several questionnaires not found in the interviewer-administered survey, such as detailed physical activity logs and diet history questionnaires, and served as an experimental run-in procedure to enhance compliance prior to randomization by encouraging women who would not participate to drop out prior to randomization. Women who completed the take home packet were eligible to complete the accelerometer assessment, in which objective physical activity data were collected. After 6 months of intervention activities, women completed a T2 health assessment.

## Measures

**Demographics—**Items assessing ethnicity, primary language spoken, household income, educational attainment, and parental educational attainment were drawn from the Maternal Infant Health Assessment survey.[21] Items from this survey have been used successfully, with samples representing a diverse range of ethnicities and socioeconomic status categories.[21,22]

**Group Cohesion—**Group cohesion was measured using the Physical Activity Group Environment Questionnaire (PAGE-Q).[19] The modified survey used in the HIP study is a 34-item, self-report questionnaire, including items related to physical activity, that assesses cohesion via perceptions of individual group members. Participants respond to items using a 9-point Likert-type scale, with answer choices ranging from strongly disagree to strongly agree. The modified PAGE-Q measures the four key dimensions of cohesion, ATGT, ATGS, GIT and GIS. For example, “I like the amount of physical activity I get with this group,” measures ATGT; “This group is an important social unit for me,” measures ATGS; “Our group is united in its beliefs about the benefits of regular physical activity,” measures GIT; and “Members of our group often socialize during meals,” measures GIS. The PAGE-Q demonstrated high reliability (Cronbach $\alpha$ = .91, .87, .72, and .85 for ATGT, ATGS, GIT, and GIS, respectively).[19]

**Psychosocial Mediators—**Psychosocial factors related to physical activity and dietary habits and hypothesized to be important in the behavioral change process included self-efficacy, motivational readiness (stage of change), and social support. Self-efficacy was measured using Bandura’s Exercise Self-Efficacy (ESE) scale.[23] The ESE is an 18-item scale with answer choices in 10-unit intervals, ranging from 0 (cannot do) to 100 (certainly can do).[23] The ESE scale demonstrated high reliability (Cronbach $\alpha$ = .97).[24]

The Exercise Stages of Change (ESC) short form was used to measure the stage of motivational readiness for physical activity. The ESC short form contains one question to determine whether the participant is at the pre-contemplation, contemplation, preparation, action, or maintenance stage of motivational readiness.[25] ESC has demonstrated good reliability ($K$ = .78).[26] A similar questionnaire was used to measure weight loss motivational readiness. The Weight Stages of Change short form contains four items to determine whether the participant is at the pre-contemplation, contemplation, action, or maintenance stage of motivational readiness for weight change.[25]

Social support for physical activity was measured using the Social Support and Exercise Survey. The survey has five items to measure family support and five items to measure peer support. The instrument has shown high internal consistency (α range = .61 to .91), and test re-test reliability ranged from .55 to .79.[27] Social support for dietary habits was measured by the abbreviated Social Support for Eating Habits Survey. The instrument showed high internal consistency (α range = .80 to .87), and test re-test reliability ranged from .57 to .86.[27]

**Physical Assessments—**Resting heart rate and blood pressure were collected by trained personnel using established protocols.[28] Height was measured using a stadiometer. Body weight, BMI, and percent body fat were measured using bioelectrical impedance analysis with a Tanita TBF-310 body composition analyzer (Tanita Corporation of America, Inc., Arlington Heights, Illinois).[29] Each measure was taken twice to enhance accuracy, and an average of the two measurements was used in analyses.

**Physical Activity—**The International Physical Activity Questionnaire (IPAQ) long form was used to measure self-reported total physical activity, including work-related, transportation, and domestic leisure-time physical activity, as well as walking-, moderate- and vigorous-intensity physical activity, over the last 7 days.[30] Physical activity was reported in terms of days per week and minutes and/or hours per day and was converted to metabolic equivalent minutes (MET-minutes). IPAQ Spearman correlations were .8 for test re-test reliability and .3 for criterion validity, indicating its acceptability for measuring physical activity in adults age 18 to 65 years.[31]

Objective physical activity data were collected using a unidirectional Acti-Graph GT1M accelerometer (Manufacturing Technology, Inc. Pensacola, Florida),[32] using previously described protocols.[33] Participants wore the accelerometer over their hip for 7 consecutive days. Accelerometer activity counts were collected using a 1-minute epoch setting. The criterion for including accelerometer data in the analysis was 4 or more days of valid wear, with a valid day being 8 or more hours of valid wear time. Valid wear time was defined as having 30 or fewer consecutive minutes of zero activity counts in a given hour.[34] Participants without 4 or more valid days of data were not included in the analysis, and invalid days were also not included in the analysis. An individual-specific cut point was applied to determine whether each minute in a 24-hour day (from 12:00 A.M. to 11:59 P.M.) was spent doing moderate or greater intensity activity.[33] Accelerometer data were organized as minutes of moderate or greater intensity physical activity per valid day. The ActiGraph accelerometer exhibited strong associations between activity counts and measured energy

expenditure, was clearly responsive to different intensities of physical activity, and had the lowest amount of variance across monitors, indicating strong validity (intraclass correlation coefficient = .87) and overall reliability.[35]

**Dietary Habits—**Dietary habits were measured using the National Cancer Institute fruit and vegetable screener and fat screener.[36,37] Fruit and vegetable consumption was reported in terms of frequency and amount consumed each time over the last month. The fruit and vegetable all-day screener was highly correlated ($r$ = .68 in men, $r$ = .49 in women) with the by-meal screener, showing adequate validity in adults.[38] The fat screener measures an individual's usual dietary intake of percent calories from fat. The fat screener showed good validity ($r$ = .64 in men, $r$ = .58 in women) in adults when compared with true intake.[36]

## Intervention

Women who completed the T1 health assessment were invited to a randomization session. Those who attended the randomization session were included in the study and analyses. At the randomization session, participants were introduced to the HIP study and learned about the benefits of increasing physical activity and eating more vegetables and fruit. We also discussed the importance of the randomization procedure and how attrition affects the power of the study. Participants were invited to continue in the study or drop out prior to randomization, and were then randomly assigned to the physical activity or vegetable and fruit group. Women met in their groups six times over the course of 6 months and were exposed to a group cohesion intervention to promote walking or increase vegetable and fruit consumption. Group cohesion intervention strategies were the same for both intervention groups and included developing a shared goal; working on team activities; and assigning team roles, such as team captain, secretary, or caller. Women were encouraged to contact each other outside of the intervention sessions to meet shared goals and share reminders. The first three sessions were 2 weeks apart. Sessions four through six were scheduled approximately 1 month apart. Intervention sessions were lead by two trained graduate students in psychology, public health, or education.

Intervention content was similar for both groups and was tailored to increasing walking or increasing vegetable and fruit consumption. Intervention sessions followed detailed scripts and protocols developed for the HIP project that were based on current literature and published recommendations, ensuring intervention efficacy and fidelity. Table 1 presents intervention content for both groups by session.

Teams were given a weekly goal at the first session and at each subsequent session, with slowly increasing weekly milestones to gradually meet recommended amounts of physical activity or servings of vegetables and fruit.[39] Women were asked to document their physical activity using weekly physical activity logs called Check and Line Questionnaires (CALQ), or to document their vegetable and fruit consumption using the Vegetable and Fruit Log.[40] In addition to the main content delivered at each intervention session, women handed in their logs, received a new team goal, and determined a plan to accomplish their new goal. At the end of each session, women in the physical activity group would go on a 15-minute group walk led by the health educator, and women in the vegetable and fruit group would

sample a new fruit or v egetable. Attendance was recorded throughout the intervention and at all assessments.

### Analyses

This study considered four primary outcomes—change in IPAQ, change in objectively measured physical activity (accelerometry), change in vegetable and fruit consumption, and change in fat consumption. Prior to analyses, normality was checked for all variables; IPAQ, accelerometer, and FV consumption variables were transformed using a natural log transformation to create a symmetric distribution. Differences in these measures between groups at baseline were evaluated using independent-samples *t*-tests. Simple changes in the outcome measures over time were evaluated using paired *t*-tests.

Mediation analyses were used to determine whether the effect of the group cohesion intervention on physical activity or dietary habits was mediated by changes in group social or task cohesion and associated changes in social support, self-efficacy, or motivational readiness. The direct and mediated effects of the group intervention on these outcomes were evaluated using a mediational chain model controlling for baseline values as well as the covariates of ethnicity, income, education, and attendance (Figure 1). The direct effect was evaluated first by testing group differences in the outcome after controlling for baseline values and the covariates; the model included correlations among the baseline measures. The mediational effect was tested in the full mediational chain model that included an indirect path from group to outcome that passed first through task or social cohesion and then through social support, self-efficacy, and motivation. This indirect path represents the hypothesized mediational chain explaining the effect of the intervention on the outcomes. This analytical approach is appropriate to test the multiple-mediator, or meditational chain, effect, not only to determine whether the intervention had the desired effect on physical activity and dietary habits but also to test how the intervention worked with respect to changing cohesion, leading to changes in the other psychosocial factors and subsequent changes in behavior.[41] These mediational models were tested using path analysis in LISREL 8.80 (Scientific Software International, Inc., Lincolnwood, Illinois).[42] A separate model was run for each combination of outcome, task or social cohesion, and social support (six measures: (1) social support for physical activity from family, (2) social support for physical activity from peers, (3) social support for diet [encouragement] from family, (4) social support for diet [discouragement] from family, (5) social support for diet [encouragement] from friends, and (6) social support for diet [discouragement] from friends), self-efficacy (one measure: exercise self-efficacy), and motivation (two measures: exercise stages of change and weight stages of change), resulting in a total of 72 models and mediational chains.

## RESULTS

### Descriptive Characteristics

Overall, women who were randomly assigned were of higher socioeconomic status than women who were not randomly assigned to an intervention group. Nearly half (46.7%) had completed college, and greater than half (52.0%) reported an income that was greater than

401% of the federal poverty level.[43] Women who did not attend randomization were somewhat older (mean = 43.5 years, standard deviation [SD] = 9.6 vs. mean = 45.7 years, SD = 9.5 in women who were randomly assigned; $t = -2.690$, $p = .007$), had a larger BMI (mean = 36.2 kg/m$^2$, SD = 11.1 vs. mean = 34.2 kg/m$^2$, SD = 8.1 in women who were randomly assigned; $t = 2.739$, $p = .006$), had lower educational attainment (37.0% completed college vs. 46.7% who were randomly assigned), and had lower income adjusted for family size (38.3% reported an income ≥ 401% greater than the federal poverty level in 2007 vs. 52.0% in women who were randomly assigned). There were no differences in physical activity or fruit and vegetable consumption. Nearly all (97%) of the sample was above the federal poverty line compared to 82% of the population in the counties of residence. The sample was much more highly educated than the population in the counties of residence. Among African American women, 77% of the sample was college graduates compared to 3% of the population in the counties of residence, and 29% of the Hispanic or Latina women were college graduates compared to 1% of the population in the counties of residence.

Participants were mostly overweight or obese (mean BMI = 34.0 kg/m$^2$, SD = 9.7) and had a mean body fat percentage of 41.8% (SD = 9.4). Women had a mean blood pressure of 123/77 mm Hg (SD = 21/14) and a mean resting heart rate of 72.3 beats per minute (SD = 13.0). Means and SDs for physical activity, dietary habits, group cohesion, and psychosocial variables of interest by group and time point are presented in Table 2. Some measures had a smaller sample size, most notably accelerometry, as a result of cost per device, logistic limitations (availability and mailing devices), and lack of adherence to wearing protocols. Of those given the accelerometer (n = 191), only 160 at T1 (physical activity, n = 112; vegetable and fruit, n = 48) and 73 at T2 (physical activity, n = 51; vegetable and fruit, n = 22) wore it correctly. Fruit and vegetable consumption varied at T2, with women in the vegetable and fruit group consuming more servings than women in the physical activity group ($t = -3.96$, $p < .001$).

**Sample-Wide Behavioral Changes Over Time—**On average, women in the physical activity group attended roughly four of the six intervention sessions (mean = 3.5 sessions, SD = 1.9), and women in the vegetable and fruit group attended three of six sessions (mean = 3.1 sessions, SD = 1.8). Paired-samples *t*-tests showed that IPAQ physical activity ($t_{[157]} = -4.115$, $p < .001$) and vegetable and fruit consumption ($t_{[180]} = -4.026$, $p < .001$) increased significantly from T1 to T2. Calories consumed from fat decreased significantly from T1 to T2 ($t_{[179]} = 5.927$, $p < .001$), indicating that women reported reduced fat consumption post-intervention. Accelerometer physical activity was slightly greater at T1 than at T2, but this difference was not statistically significant ($t_{[48]} = .148$, $p = .883$).

## Direct Effect of Group Assignment

After analysis was adjusted for relevant baseline variables, including ethnicity, income, education, and attendance, the vegetable and fruit group had a significantly larger increase in fruit and vegetable consumption over time compared with the physical activity group ($t = 4.390$, $p < .001$). Group assignment had no significant effect on changes over time in self-reported IPAQ physical activity ($t = .810$, $p = .418$), accelerometer-measured physical activity ($t = .476$, $p = .634$), or fat consumption ($t = -.431$, $p = .666$).

### Mediation Effects

As suggested by Figure 1, we found some support for a mediational effect of cohesion and psychosocial factors leading to behavior change. Participation in the physical activity intervention increased task cohesion, which led to improved motivational readiness that in turn led to increased IPAQ physical activity scores (β = −.07, standard error [SE] = .03, $p$ = .016). Thus, the physical activity intervention was effective in improving task cohesion in the physical activity group (γ = 2.156, SE = .440, $p$ < .001). In the physical activity group, improved task cohesion was also associated with greater improvements in family support for physical activity (β = .88, SE = .33, $p$ = .004), peer support for physical activity (β = .87, SE = .28, $p$ = .001), exercise self-efficacy (β = 3.70, SE = 1.48, $p$ = .006), exercise stages of change (β = .62, SE = .26, $p$ = .009), and weight stages of change (β = .49, SE = .21, $p$ = .011). However, improvements in these psychosocial factors did not result in larger improvements in either self-reported IPAQ physical activity or accelerometer physical activity in the physical activity group.

Several of the hypothesized mediating variables were related to changes in outcomes in the vegetable and fruit group. Changes in exercise self-efficacy were associated with improvements in IPAQ physical activity (β = .25, SE = .08, $p$ = .002) and accelerometer-measured physical activity (β = .02, SE = .01, $p$ = .013). Discouragement from friends for diet (β = −.10, SE = .05, $p$ = .013) resulted in lower consumption of calories from fat in the vegetable and fruit group. However, none of these effects were attributable to a mediational pathway.

Neither intervention had an effect on social cohesion (γ = .079, SE = .495, $p$ = .873). Consequently, none of the associated mediational hypotheses involving social cohesion were supported.

## DISCUSSION

The purposes of the HIP study were to determine the effects of a group cohesion physical activity or dietary habits intervention and to determine whether the effect of the intervention was mediated by changes in group task or social cohesion and expected associated changes in social support, self-efficacy, and motivational readiness. Across both intervention groups, women reported significant increases in physical activity and fruit and vegetable consumption and decreases in dietary fat, suggesting that the HIP intervention had beneficial effects and improved participants' health behaviors. Women assigned to the dietary habits condition reported significantly greater increases in fruit and vegetable consumption compared with those in the physical activity intervention, suggesting that information specific to dietary habits was important to promote changes in these health habits. Those assigned to the physical activity group experienced increases in group task cohesion, which in turn contributed to expected psychosocial mediators; however, this did not contribute to physical activity in the meditational chain. No changes or relationships were associated with group social cohesion.

Analyses investigating the hypothesized mediated pathways found limited support for the group cohesion intervention. The group cohesion physical activity intervention had the

expected impact of increasing task cohesion in the physical activity group, suggesting that the intervention elements focused on the task of physical activity were effective to create some elements of group cohesion. This is consistent with previous theory[17,18] and research[19,44,45] and extends the applicability of group cohesion interventions to the vulnerable populations of African-American and Hispanic or Latina women. African-American and Hispanic or Latina women may be particularly responsive to group cohesion interventions,[46] because they may empower women to perceive a group identity[47] with greater collective efficacy to improve their lives.[48] The improvement in task cohesion is a similar construct to collective efficacy, defined as the belief that the group can improve their health through collective effort,[48,49] with a focus on shared goal setting and activities aimed at achieving a mutually agreed upon goal.

We also found some support for previous research linking task-related cohesion with other psychosocial variables of social support[47,50,51] and self-efficacy,[48,52] as these were important parts of the meditational chain. Nevertheless, these improvements did not translate to increases in physical activity. Despite the breakdown in the chain, even in the absence of cohesion, other important psychosocial factors, such as self-efficacy and social support, did develop during the intervention that in turn contributed to desirable behavioral changes. The intervention was developed on the basis of group dynamics theory, and expected changes did occur, but they were not attributable to group cohesion. This curious break down in the chain may point toward limitations in the measure or intervention delivery strategy. Few studies have tested group cohesion, and fewer have looked at meditational pathways, making the contribution of these findings important for moving the field toward better understanding of how people adopt and sustain new behaviors.

To our surprise and dismay, our carefully crafted, theoretically grounded intervention had virtually no impact on group social cohesion, implying that the social dimensions of the intervention had no impact on outcomes, in contrast to what others have found.[19] Perhaps the intervention was not sufficient or frequent enough in dose to develop social cohesion dimensions, or perhaps women already had existing social sources in their lives, so there was little room for improvement. Some theorists have suggested that the measurement of cohesion is still in a neophyte stage, with little understanding of specific mechanisms important to the development of cohesion, such as the constructs of cooperation and competition.[53] The baseline values of social cohesion in this study that were based upon the 9-point Likert scale suggest that participants in both groups had modest social cohesion at the commencement of the program, which did not increase significantly. Relative to other studies that have assessed group cohesion in a similar way, the baseline social cohesion scores in this study were within the typical range seen across studies.[15,19,44,54–57] In addition, the lack of a true control group may have masked the impact of group cohesion on outcomes and prevented comparison with a non–group cohesion–based intervention group. Some of the previous work that has found robust associations was done with senior populations, who may have fewer existing social resources.[19] Perhaps this social dimension of group cohesion theory is not applicable in all populations. The 24% of participants who expressed initial interest in participating but failed to return to the randomization visit were older, had a higher BMI, had lower educational attainment, and had lower income than the women who engaged in the interventions. It could be that, in addition to having more health

and socioeconomic advantages, women who engaged in the interventions also had greater social resources embedded within their daily lives, whereas the women with fewer social resources dropped out. If this were the case, perhaps the intervention did not reach the populations who were most likely to benefit from the social aspects of the intervention. Future research is needed to understand whether stronger intervention dose is needed, whether women do not respond to this dimension of group cohesion, or whether the measurement instruments don't capture this dimension of cohesion in African-American and Hispanic or Latina women of relatively high socioeconomic status.

This study relied on a sizeable sample of African-American and Hispanic or Latina women, using multiple measures of physical activity and dietary habits. Although accelerometers are widely considered state of the art in physical activity measurement, cost constraints limited their use to a subsample of the complete and eligible sample, which may have affected the power to detect effects of the mediational pathways. Lack of adherence and a smaller sample size at T2 as a result of dropout may have additionally affected this. Although our strategy to encouraged attrition prior to randomization was effective in eliminating early dropouts, other factors may have been a barrier to attending sessions and assessments post-randomization, contributing to attrition rates on par with those observed in other studies of this population.[58–63] Another anecdotal concern is that it is not clear that accelerometry is as reliable when used on obese, community-based populations, which may make it difficult to detect changes in physical activity as a result of participation in the intervention. Other research by this group has found relatively low correspondence between accelerometer measures and physical activity self-report questionnaires and diaries[40] and low correspondence with heart rate monitors.[64] It is not clear whether the low correspondence represents over reporting or measurement bias among obese populations, or whether some forms of physical activity are simply not captured by accelerometers Future studies are needed to improve community-based physical activity assessment methods, to contribute to better theoretical and applied tailoring of research in overweight and obese populations.

This study found no support for the hypothesized mediational pathways focusing on dietary habits, potentially suggesting that group cohesion may be less effective for changing dietary habits in African-American and Hispanic or Latina women. However, little work has been done in this arena, and it is possible that the intervention designed for this study was simply not sufficient for increasing group cohesion and that other group cohesion interventions might be effective. In addition, the questionnaire that assessed group cohesion was designed for measuring physical activity related cohesion rather than dietary habits related cohesion, suggesting a need to develop measures that are more specific to the particular behavioral domain under investigation. Perhaps more precise measurements that are focused on dietary habits would have borne out a clearer meditational pathway. An additional factor contributing to improvements in health habits across both groups may be attributed to the finding in exit interviews that greater than two-thirds of participants identified weight loss as the primary reason for joining the study. The HIP study was not designed with weight loss in mind, nor was information about weight loss or healthy body weight included in the intervention programming. Regardless, motivational readiness for weight change improved in both groups, suggesting that weight loss was paramount on our participants' minds.

Perhaps desires for weight loss, rather than the simple goals of increasing physical activity or improving dietary habits, contributed to the outcomes beyond any group cohesion factors.

The group cohesion interventions appeared to provide benefits to the women who participated in them; however, the HIP project may yield more questions than it was able to answer. Our models suggested that group cohesion interventions provided many of the same benefits to psychosocial and behavioral outcomes and provided improvements in cohesion around the task of increasing physical activity. However, we did not see expected increases in physical activity as measured by accelerometer. Future studies are needed to determine whether the necessary dose of intervention is greater, whether other channels of delivery, such as the Internet, might be capitalized on to improve outcomes, or whether group cohesion interventions simply don't work for increasing physical activity with this population. The vexing problems of increasing physical activity, improving dietary habits, and maintaining healthy and attractive body weights merit additional study in the most vulnerable and growing population of African-American and Hispanic or Latina women.

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## SO WHAT? Implications for Health Promotion Practitioners and Researchers

**What is already known on this topic?**

Physical inactivity and poor dietary habits increase the risk of obesity and related health conditions. Group cohesion interventions are effective for improving health behaviors and foster high participation rates, yet little work has been done to describe the underlying mechanisms of cohesion that drive behavior change.

**What does this article add?**

This study extends previous research by increasing our understanding of the role of group cohesion on psychosocial outcomes, physical activity, and dietary habits in African-American and Hispanic or Latina women—vulnerable populations for whom no similar study exists. Although we did not see behavioral changes as a result of changes in psychosocial factors, this work provides deeper insight into the complex relationships among group cohesion, psychosocial factors, and physical activity and dietary habits among African-American and Hispanic or Latina women.

**What are the implications for health promotion practice or research?**

A better understanding of how intervention dose may affect outcomes and further research on alternative delivery strategies are needed to inform health intervention and policy efforts aimed to improve health outcomes.

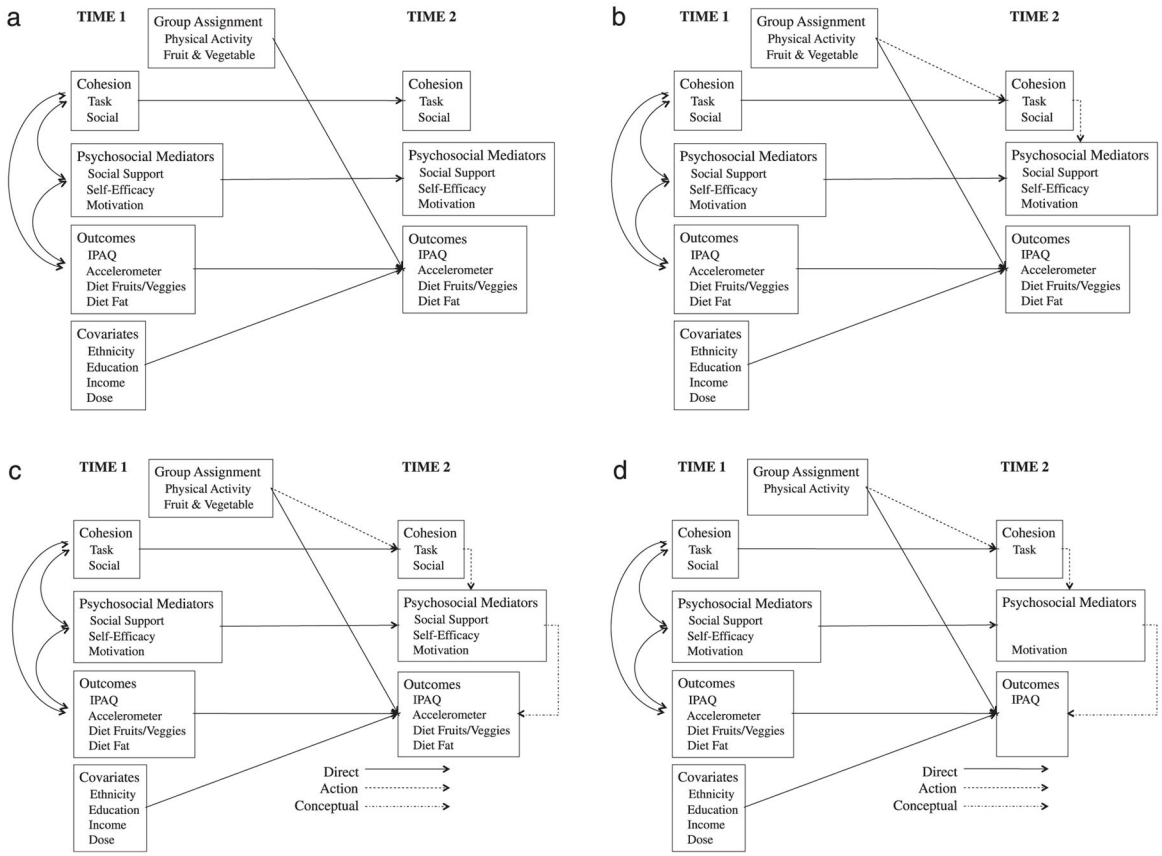


**Figure 1. Mediational Chain Model**

(a) Direct effect of time 1 variables on time 2 variables. (b) Direct effects plus indirect effects of Time 1 and Time 2 variables on Time 2 mediators. (c) Direct and indirect effects from (b) plus indirect effects of Time 1 and Time 2 variables on Time 2 outcomes. (d) Confirmed mediational relationships of Time 1 and Time 2 variables on Time 2 outcomes.

## Table 1

Intervention Content by Session for Physical Activity and Vegetable and Food Groups

| Session | Physical Activity Content | Vegetable and Fruit Content |
|---|---|---|
| 1 | Social cohesion | Social cohesion |
| | Forming teams | Forming teams |
| | Safety when walking | Using the vegetable and fruit log to record fruit and vegetable servings |
| | Using the CALQ* to record activity | Food safety |
| 2 | Shared goal setting | Shared goal setting |
| | Barriers to physical activity | Barriers to eating vegetables and fruit |
| | Social justice and the physical activity environment | Social justice and the food environment |
| 3 | Social support for physical activity | Social support for vegetable and fruit consumption |
| 4 | Benefits and self-efficacy and physical activity | Benefits and self-efficacy and vegetable and fruit consumption |
| 5 | Relapse prevention and physical activity | Relapse prevention and vegetable and fruit consumption |
| 6 | Recommendations and long-term goals for physical activity | Recommendations and long-term goals for vegetable and fruit consumption |

* CALQ indicates Check and Line Questionnaire.

## Table 2

Physical Activity and Dietary Habits by Group and Time

| Variable | Physical Activity | | Vegetable and Fruit | |
|---|---|---|---|---|
| | Time 1 (n = 204), Mean (SD)* | Time 2 (n = 118), Mean (SD) | Time 1 (n = 106), Mean (SD) | Time 2 (n = 58), Mean (SD) |
| Physical activity | | | | |
| IPAQ total, MET min per week*† | 2563.5 (3976.9) | 3015.5 (2900.6) | 2295.8 (2585.6) | 3465.4 (2741.6) |
| Accelerometer, min in moderate or greater per day | 21.3 (21.2) | 21.1 (19.9) | 15.8 (13.4) | 16.5 (10.8) |
| Dietary habits | | | | |
| Fruit and vegetable consumption, servings per day† | 3.0 (3.1) | 3.2 (2.4) | 2.7 (2.1) | 4.9 (3.1) |
| Fat consumption, % of calories per day† | 31.7 (3.7) | 30.2 (3.1) | 32.1 (4.3) | 30.2 (4.1) |
| Group cohesion | | | | |
| Task cohesion | 11.9 (2.4) | 14.1 (2.3) | 11.2 (2.6) | 12.1 (2.5) |
| Social cohesion | 11.2 (2.1) | 11.0 (2.7) | 10.7 (2.6) | 11.6 (2.9) |
| Psychosocial variables | | | | |
| Exercise self-efficacy | 47.9 (21.1) | 49.1 (21.0) | 40.1 (22.4) | 41.3 (18.9) |
| Exercise stages of change† | 3.2 (0.9) | 4.2 (0.9) | 3.2 (0.7) | 3.6 (1.0) |
| Weight stages of change | 3.0 (0.7) | 3.1 (0.7) | 3.0 (0.7) | 3.0 (0.7) |
| Social support for physical activity from family† | 9.2 (4.4) | 10.3 (4.8) | 8.8 (4.2) | 9.0 (4.7) |
| Social support for physical activity from peers† | 8.4 (3.5) | 10.3 (3.5) | 8.3 (3.3) | 9.8 (3.6) |
| Social support for diet (encouragement) from family† | 14.2 (6.1) | 13.9 (6.2) | 13.0 (6.3) | 15.5 (6.1) |
| Social support for diet (discouragement) from family | 14.1 (5.5) | 13.4 (5.6) | 13.1 (5.6) | 13.1 (5.7) |
| Social support for diet (encouragement) from friends | 12.8 (5.7) | 13.3 (5.4) | 12.0 (5.3) | 13.3 (5.4) |
| Social support for diet (discouragement) from friends | 13.4 (5.7) | 11.6 (4.8) | 11.9 (5.5) | 12.1 (5.8) |

*SD indicates standard deviation; IPAQ, International Physical Activity Questionnaire; MET, metabolic equivalent.

†Indicates a statistically significant difference between Time 1 and Time 2 across groups ($p < .05$).