HHS Public Access
Author manuscript
J Behav Med. Author manuscript; available in PMC 2020 April 10.

Published in final edited form as:
J Behav Med. 2018 February ; 41(1): 87–98. doi:10.1007/s10865-017-9876-5.

Guided imagery targeting exercise, food cravings, and stress: a multi-modal randomized feasibility trial

Peter Giacobbi Jr.[1], **Dustin Long**[2], **Richard Nolan**[3], **Samantha Shawley**[4], **Kelsey Johnson**[3], **Ranjita Misra**[5]

[1]Department of Sport Sciences, Joint Appointment, Social and Behavioral Sciences, West Virginia University, Health and Education Building, 208, 375 Birch Street, P. O. Box 6116, Morgantown, WV 26506-6116, USA

[2]Department of Biostatistics, School of Public Health, University of Alabama at Birmingham, 1665 University Boulevard, Ryals Public Health Building, Room 327, Birmingham, AL 35294-0022, USA

[3]School of Medicine, West Virginia University, Morgantown, WV, USA

[4]School of Public Health, West Virginia Univesity, Morgantown, WV, USA

[5]Department of Social and Behavioral Sciences, School of Public Health, West Virginia University, 3301 HSC South, Morgantown, WV 26505, USA

Abstract

The purpose of this randomized wait-list controlled trial was to test the feasibility and preliminary efficacy of a guided imagery based multi-behavior intervention intended to address psychological stress, food cravings, and physical activity. Personalized guided imagery scripts were created and participants were instructed to practice guided imagery every day for 35 consecutive days. Of 48 women who enrolled, we report comparisons between 16 randomized to treatment with 19 who were wait-listed (overall M_{age} = 45.50; $M_{bodymassindex}$ = 31.43). Study completers reported 89% compliance with practicing guided imagery during the intervention. A significant time-by-group interaction was observed with reductions in food cravings and increases in physical activity compared with wait-list controls. Telephone-based multi-behavior interventions that utilize guided imagery to address food cravings and exercise behavior appear to be acceptable for overweight and obese women. Future phone-based guided imagery research testing this skill to address multiple health behaviors is justified.

Keywords

Food cravings; Exercise Stress; Guided imagery

Peter Giacobbi Jr. prgiacobbi@mail.wvu.edu.

Compliance with ethical standards

Conflict of interest Authors Peter Giacobbi, Jr., Dustin Long, Richard Nolan, Samantha Shawley, Kelsey Johnson, and Ranjita Misra declare that they have no conflicts of interest.

Human and animal rights and Informed consent All procedures followed were in accordance with ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

Introduction

The dramatic increase in adults who are overweight or obese is a global public health challenge. The World Health Organization (WHO) has estimated that at least 1.5 billion adults over the age of 20 were overweight while 200 million men and almost 300 million women were obese (WHO, 2010). In 2012, 68.5% of adults in the United States were either overweight or obese, 34.9% were obese, and 6.4% were extremely obese (Flegal et al., 2012; Ogden et al., 2012; Schiller et al., 2012). Individuals who are overweight or obese are more prone to chronic diseases such as coronary heart disease, stroke, type-2 diabetes, and certain forms of cancer (US Department of Health and Human Services, 2008). The United States Centers for Disease Control and Prevention (CDC) estimated that direct medical costs related to obesity in 2012 were 147 billion dollars, while health care costs were $1429 higher for obese as compared to normal weight individuals (Finkelstein et al., 2009). Finding effective ways to reduce the health impacts of being overweight or obese is an urgent public health challenge.

One emergent tool that may improve dietary regulation and increase exercise behavior involves the use of guided imagery. Guided imagery is a quasi-perceptual, multisensory, and a conscious experience that closely resembles the actual perception of some scene, event, or object, but occurs in the absence of an external stimuli (Thomas, 2016). This cognitive technique has been used by psychologists to help individuals cope with pain, stress or anxiety, and may be an effective treatment or adjunct for those with arthritis and other rheumatic diseases (Giacobbi et al., 2015; Verkaik et al., 2014). Separate lines of scientific inquiry have shown that guided imagery can be an effective intervention strategy to help individuals increase physical activity (Chan & Cameron, 2012; Duncan et al., 2012), modify food consumption and cravings (E. Kemps & Tiggemann, 2014; Missbach et al., 2014; Morewedge et al., 2010), and cope with stress (Bhutani, 2015; Bigham et al., 2014), the three behaviors targeted in the present investigation. With regard to physical activity, researchers in one study instructed participants to listen to a 5-minute guided imagery CD each day for two weeks (Andersson & Moss, 2011). Results showed that participants randomized to the guided imagery condition significantly increased their physical activity compared to relaxation and attention control groups (Andersson & Moss, 2011). Other randomized controlled trials (RCTs) have demonstrated that guided imagery can increase enjoyment of exercise and self-determined motives to engage in exercise behavior (Duncan et al., 2012; Giacobbi et al., 2014; Stanley & Cumming, 2010).

Guided imagery has recently been tested as a strategy to reduce food consumption and cravings. In one report of five experiments, individuals who were tasked with imagining a food, such as cheese, consumed significantly less and reported fewer cravings after being exposed to this food than those who imagined eating less of the same food, visualized eating a different food, or imagining a neutral stimulus (Morewedge et al., 2010). Another RCT showed that participants randomized to practice guided imagery reported significantly higher fruit consumption at 7-days follow-up compared to those assigned to goal intention and implementation conditions (Knauper et al., 2011).

Others have noted theoretical and empirical links between psychological stress, food cravings, physical inactivity, and increased body mass index. (Potenza & Grilo, 2014). It has been speculated that chronic stress may be associated with decreased physical activity, increased sedentary behavior, and increased food cravings (Chao et al., 2015). Results from one cross-sectional study showed chronic stress had significant direct effects on food cravings and food cravings had a direct effect on body mass index: food cravings partially mediated the association between chronic stress and body mass index (Chao et al., 2015). Others have theorized that ‘‘reward-driven eating,’’ which is characterized by a preoccupation with food, lack of control over food consumption, lack of satiety, and the inability to cope with stress may be important factors contributing to the overconsumption of food (Mason et al., 2016). In this RCT, Mason and colleagues compared the effects of a diet and exercise intervention with or without mindfulness training on 194 obese adults. Compared to controls, mindfulness training resulted in significant reductions in food cravings at 5.5 months, which then predicted weight loss at 12 months. Reward driven eating mediated the effect of the intervention at 12 months while psychological stress did not mediate the effects of weight loss at either time point. Another study showed that a mindfulness-based intervention with women resulted in significant decreases in food cravings (Alberts et al., 2012). These findings warrant the continued study of multi-behavior interventions that simultaneously target psychological stress, food cravings, and physical activity behavior.

Guided imagery has also been used for stress management. A two group non-randomized trial tested a cognitive-behavioral program with 117 participants who completed different doses of imagery exposure across several weeks. Results showed participants who completed the study (77.8%) had significant improvements in mental well-being scores from pre- to post-test that were sustained during a follow-up period (Bhutani, 2015). Guided imagery is also an effective treatment for post-traumatic stress disorder and is considered an important part of cognitive-behavioral therapies (Casement & Swanson, 2012; Holmes et al., 2007).

The present study sought to extend the research literature that addresses multiple health behaviors by: (a) using guided imagery as the primary behavior-change strategy; (b) tailoring three guided imagery scripts as per participant needs to promote relaxation (script one), specific foods that participants indicate cravings for (script two), and focusing on their choice of exercise or physical activity (script three); (c) targeting overweight and obese women; and (d) the provision of weekly telephone support.

Self-determination theory (SDT) guided the delivery of the intervention (Deci & Ryan, 1985; Ryan & Deci, 2000; Ryan et al., 2008). SDT predicts that individuals have three basic psychological needs or nutriments: autonomy, of competence, and relatedness. When these needs are met in a given behavioral context, individuals are thought to be autonomously or intrinsically motivated whereby they engage in this behavior for the joy and pleasure of the activity itself. Extrinsically motivated behaviors are performed for praise from others or contingencies in the environment. While individuals typically engage in health behaviors for both intrinsic and extrinsic motives, they are more likely to adhere to behavioral changes with internalized motives since these are characterized by enjoyment and satisfaction.

Recent RCTs and systematic reviews support SDT as a framework to address weight management with overweight and obese women (Silva et al., 2010; Teixeira et al., 2012). In the present study, the intervention delivery agents were trained in the application of SDT in ways that will be described.

The purposes of this wait-list randomized controlled trial were to test the feasibility, acceptability, and short-term efficacy of a multi-behavior intervention that simultaneously targets psychological stress, food cravings, and physical activity with overweight and obese women. This trial began in a laboratory setting while the remaining part of the intervention was conducted over the telephone. Because this study was primarily focused on participant acceptability and feasibility of using guided imagery, no hypotheses were put forth.

Methods

Participants

All study procedures were approved by a university institutional review board and recruitment occurred from January 2013 to June 2015. The original inclusion criteria were for all participants to have a body mass index equal to or greater than 25 kg/m^2 but these criteria resulted in too few participants. The revised inclusion criteria included having a body mass index (BMI) greater than or equal to 25 kg/m^2 and/or self-reported participation in exercise one or fewer days per typical week. Additional eligibility criteria included the following: (a) women age 18 years or older; (b) capable of engaging in moderate intensity exercise; (c) willingness to be randomized to experimental or wait-list control conditions; and (d) ability to complete weekly telephone coaching, access to the internet and use of email, and the study protocol. The exclusion criteria included being pregnant during study enrollment or having a medical condition that may prevent individuals from safely engaging in standard exercise recommendations (e.g., heart problems, pregnancy, high blood pressure etc.). Participants were provided a $15.00 gift card as incentive upon completion of the study.

Recruitment procedures included posting fliers at grocery stores, on a university campus (e.g., public bulletin boards in departments, residence halls, and campus recreation facility), and local churches. Additionally, print advertisements in local media outlets and postings on university faculty and staff email lists were utilized. Interested potential volunteers contacted study personnel by telephone or email and were asked to provide their height, weight, and typical frequency and types of exercise behavior.

Study design and procedures

The study design was a wait-list randomized controlled trial (RCT) with baseline measures for those wait-listed (pre-intervention) being used as comparative pre-intervention data while post-test assessments for both groups allowed for the analysis of change over time (Fig. 1).

Interested participants were screened for initial eligibility over the telephone. Eligible participants individually met with the research team, were briefed about the study procedures, pre-tested, and then randomized (week 1). Those randomized to begin the intervention completed the procedures described below and post-tested (week 6). Those initially assigned to the wait-list completed identical testing procedures and methods about 6 weeks later (week 6) and posted-tested (week 12): data from testing session two for those initially randomized to the wait-list was used in this analysis. Those wait-listed were instructed to maintain current lifestyle practices, avoid interactions with other enrolled participants in the study, and have minimal contact with study personnel. Since this was a feasibility study, no follow-up data was obtained.

The rationale for using a wait-list control group were the following: (a) use of a wait-list control group facilitated participant recruitment during the entire study period as both the experimental and control groups received the intervention albeit six-weeks apart; (b) assessments could be made of changes between pre-and post-test, and (c) to compare time-by-group changes across the trial.

The intervention

The intervention began with the assignment of a health educator to work with each participant immediately after pre-testing. During this initial meeting, which was the only in-person meeting with health educators, the participants reviewed a workbook that was provided to all research participants. The workbook was collected at the end of the study in an effort to verify that participants practiced guided imagery on a daily basis, as required by the study protocol. The workbook consisted of sections about values and individual goals, information about diet and exercise, internet resources (e.g., ChoseMyPlate.gov and the American College of Sports Medicine website), examples of diverse forms of physical activity, self-monitoring techniques such as the ratings of perceived exertion scale, and places to record notes. The discussion about values and health-related goals was followed by the creation of the guided imagery scripts.

The process of creating the guided imagery scripts began with a stress/relaxation script since it was believed that the application of guided imagery would be easier to understand for novices or those with limited formal experience practicing guided imagery to address other behaviors. The second script targeted a specific food the participants hoped to regulate or eliminate from their diet. Participants were instructed to develop scripts that focused on specific foods they craved since previous research has demonstrated reductions in intake and cravings when individuals imagined consuming foods such as cheese or chocolate (Morewedge et al., 2010). All participants were also given a general exercise imagery script that allowed for modification of the specific activities they could imagine while maintaining the followed elements: (a) imagining a place to exercise; (b) a warm-up activity; (c) images of increased exercise plus increases in breathing and heart rate; (d) coping with vigorous exercise; and (e) a cool-down period. All three guided imagery scripts were designed to elicit realistic images that included experiences that evoked all five sensory modalities. For instance, the stress reduction script guided participants through a place they could visually see by including detailed images of colors, sights, sounds, smells, emotions, and muscular sensations. The food cravings script focused participant’s images of specific foods and was designed to elicit sensory images of tastes, sounds, smells, emotions, and descriptions of eating their targeted food. The latter part of the food craving script also included statements concerned with satiety and control over portion sizes. Participants were instructed to read each guided imagery script at least once a day at a time of their choice for 35 days and record each practice session in their workbooks. The workbooks were collected and reviewed for adherence to the study protocol during post-testing. Participants were encouraged to modify their scripts and provide information about any changes to their assigned health educators during the 35-day program. The written scripts ranged in size from about 150–400 words depending on the amount of detail the participants offered during the initial meeting.

The health educators conducted weekly telephone conversations with participants. A total of five conversations were scheduled and focused on the participant's goals during the first part of the conversation. The second part of each conversation involved the health educator reading the participants' script to the participant verbatim: the pronouns in the guided imagery scripts read to participants were changed from ‘‘I’’ to ‘‘you.’’ Completion and the length of each telephone conversation was recorded.

Health coach training and quality control

Health educators were trained in the use of guided imagery, the application of SDT, and ways to establish a professional relationship with participants. The training involved readings and discussions focused on SDT and mental imagery (Ryan et al., 2008) along with role playing activities that mimicked the telephone conversations. Health educators applied the tenets of SDT as follows: (a) the use of neutral language without the use of prescriptions; (b) the provision of information related to diet, exercise, and stress reduction while allowing the participants to make their own behavioral choices; (c) encourage participants to explore and discuss their values and make connections between their values and their ways of coping with stress, dietary and physical activity behavior; and (d) the use of positive informational feedback to support efforts towards goal attainment rather than specific out-comes.

Health educators followed a standard telephone script for each conversation that involved checking-in about diet and physical activity efforts followed by the health educator reading the guided imagery scripts to the participants. The statements made by the health educators only were audio-recorded and reviewed by the senior investigator in order to provide informational feedback about the application of SDT and guided imagery during scheduled meetings.

Measures

Participant's self-reported demographic information included date of birth, race/ethnicity, level of education, and marital status. Height was assessed using a standard tape measure, body weight was measured using a Tanita BF-679 Scale, while body mass index (BMI) was calculated by the following formula: ([pounds/inches^2] × 703). Demographic measures and assessments of height and weight only occurred at baseline, while the remaining measures were conducted at baseline and post-intervention.

Exercise behavior

The Godin leisure-time exercise questionnaire (GLTEQ) is a 3-item questionnaire that measures the number of bouts of 30 min or greater an individual engages in mild (e.g., minimal effort, not sweating), moderate (e.g., not exhausting, light sweating), and strenuous (e.g., heart beats rapidly) exercise during the previous 7-day period. Previous research has shown that the Godin questionnaire is a valid and reliable measure of leisure time exercise behavior (Godin & Shephard, 1985). Consistent with previous investigations, a MET estimate was computed by weighting the intensity level and summing for a total score: MET = 3(mild) + 5(moderate) = 9(strenuous). The GLTEQ has a long history of use and is considered a valid and reliable self-report measure of exercise behavior (Jacobs et al., 1993).

Trait food cravings

The trait food cravings questionnaire was used to measure general food cravings in four dimensions: preoccupation with food (e.g., I have an intense desire to eat something tasty), loss of control once eating (e.g., Once I start eating I have trouble stopping), positive outcome expectancy from eating (e.g., I feel less anxious after I eat), and emotional cravings (e.g., I crave foods when I'm upset) (Nijs et al., 2007). Participants responded to each item using a Likert scale from 1 (never or not applicable) to 6 (always) indicating the extent to which the information is generally true. The trait food cravings questionnaire has adequate reliability and validity for use as a general measure of food cravings and scoring interpretations.(Nijs et al., 2007) Consistent with psychometric evidence a total trait food cravings score was used (Nijs et al., 2007; Vander Wal et al., 2007).

Perceived stress

The Perceived Stress Scale, a 14-item survey was used to assess the participant's level of stress. Both positive and negative life events were used to determine the level of stress in one's life. Scores of the positive items were reversed and added to the negative items for a final score (Cohen et al., 1983).

Exercise motivation

Exercise Motivation Scale (EMS). The EMS is a 31-item standardized SDT-based survey that measures motivation to exercise (Li, 1999). The scale has demonstrated reliability and factorial evidence to support scoring interpretations with multiple samples of exercisers (Li, 1999; Wininger, 2007). The EMS consists of eight subscales along the self-determination continuum: amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, intrinsic motivation to learn, intrinsic motivation to accomplish tasks, and intrinsic motivation to experience sensations. For this study, the EMS was scored by weighting the 8 subscales to form a single indicator along the self-determination continuum.

Data analysis

Participation in the study protocol was tracked by retaining records about the date and time of each telephone call and the number of times participants practiced their guided imagery scripts as recorded in their workbooks. Descriptive statistics were computed for all study variables. Demographic data were compared across intervention arms by non-parametric Mann–Whitney Wilcoxon rank sum tests. Further analysis employed separate general linear mixed effects models to estimate time trends for Trait Food Cravings, MET, and perceived stress by group. These random intercept models adjust for the within subject correlation over time using a random intercept for each subject. The interaction between group and time is of primary importance as this term indicates if the two groups changed differently over time, that is, did the intervention group improve relative to the control group? Due to differences between groups at baseline, we adjusted for group, allowing the intercept to differ by group, thus maintaining the interpretation of the group by time interaction term discussed above. The data analysis for this paper was generated using SAS software (Copyright 2015 SAS Institute Incorporated).

Results

The CONSORT diagram, shown in Fig. 2, baseline assessments were obtained from 48 women and 35 completed all study procedures and post-testing. Reasons for dropping out were ascertained from 8 of the 13 dropouts and included time constraints (n = 3), health concerns (n = 2), becoming pregnant (n = 1), could not use imagery (n = 1), and parent's health concerns (n = 1). Baseline characteristics of the participants are shown in Table 1, along with other descriptive statistics, which shows that the average age and body mass index for the entire sample was 45.50 and 31.43 respectively. For study completers across both study conditions, the average number of phone conversations with health educators was 4.68 (SD = .93), the average length of the phone conversations was 25 min (SD = 15.81), but there were nonsignificant differences in the number or length of conversations between study completers and dropouts. Participants who completed the study practiced imagery an average of 31.2 days (SD = 7.15): we were unable to collect the guided imagery workbooks from those who dropped out.

Results of Mann–Whitney tests revealed significant differences in self-reported exercise between the two groups with those randomized to the wait-list reporting more exercise. No other group differences were observed at baseline.

Linear mixed effects models testing for time-by-group interactions were computed in order to test for between group differences in exercise behavior, exercise motivation, trait food cravings, and perceived stress from pre- to post-test. Since there were significant differences in typical exercise behavior at baseline, separate analyses adjusted for group assignment (Model 1), baseline exercise (Model 2), and both group assignment and typical exercise behavior (Model 3). Results presented in Table 2 showed that there were significant changes in reported exercise from pre- to post-test compared to the wait-list controls. This significant interaction is shown graphically in Fig. 3. Additionally, group-by-time interactions showed that the guided imagery intervention resulted in significant reductions in food cravings, compared to wait-list controls, across time (Fig. 4). Non-significant changes in perceived stress and exercise motivation were observed (Table 2).

Finally, post-intervention interviews with 29 participants revealed that 24 would continue using guided imagery in the future, 2 stated they would not and perceived this technique as ineffective, and 3 were unsure about continued usage.

Discussion

This study examined the feasibility, acceptability, and preliminary efficacy of a multi-behavior intervention that relied predominantly on guided imagery to address psychological stress, food cravings, and exercise behavior. Showing support for feasibility and acceptability, study completers across both conditions practiced guided imagery most days of the 35-day intervention and participated in weekly telephone conversations with health educators. While two participants stated they would not continue using this technique, a majority found it acceptable, thereby demonstrating feasibility of using guided imagery to simultaneously address psychological stress, food cravings, and physical activity behaviors. The observation that some individuals do not find guided imagery acceptable is generally consistent with other studies that showed guided imagery may not be acceptable for all individuals (Giacobbi et al., 2014). Other research has shown that some individuals are generally skeptical about integrative health techniques such as meditation and hypnosis. (Bishop et al., 2007; Furnham et al., 1995; Nichol et al., 2011) Given these findings, it would seem important to learn more about potential barriers to guided imagery use and identify individuals who are more likely to embrace this technique prior to engaging in future similar interventions.

Simultaneously targeting exercise behavior, food cravings, and psychological stress with guided imagery is novel given that most previous studies using guided imagery only focused on single outcomes (Bhutani, 2015; Bigham et al., 2014; Chan&Cameron,2012;Duncanetal.,2012;Kemps& Tiggemann, 2014; Morewedge et al., 2010). Although the present study was focused on PA behavior and two closely linked constructs that may be related to health behavior regulation, food cravings and stress, it is our hope that the findings presented here may inform the literature on multi-health behavior change interventions (Emmons et al., 2005; Geller et al., 2016; Hawkes et al., 2012, 2013; Spring et al., 2012; van Berkel et al., 2014). For instance, a recent review of behavior change techniques used in single versus multiple health behavior change interventions addressing PA only and diet and PA demonstrated participants are often given multiple and varied prescriptions (Mc Sharry et al., 2015). While documenting 38 behavior change skills or techniques across the 61 studies, those that targeted multiple behaviors implemented a greater number of techniques (M = 11.68) compared to single strategy interventions (M = 8.71). The multi-modal intervention reported here relied primarily on guided imagery, goal setting, and the provision of a health educator, making this approach less time consuming for participants. This is important because guided imagery is relatively easy to teach and may prove to be a cost-effective approach in future weight management trials.

An important finding from this study was the significant changes over time, compared to baseline data for wait-listed controls, observed in 2 of the 3 targeted behaviors: exercise behavior and food cravings. While previous investigations that used guided imagery to address diet or exercise showed promise (Chan & Cameron, 2012; Duncan et al., 2012; Kemps & Tiggemann, 2014; Missbach et al., 2014), the present study used this intervention modality to simultaneously target both using a telephone health education protocol. These findings are important for two reasons. First, simultaneous increases in energy expenditure along with reduced cravings, and perhaps intake of specific foods have potential to alter body weight over longer periods of time. Although the brief intervention used here was not intended to establish changes in body weight, these findings justify the continued examination and testing of guided imagery as a tool to help individuals lose body weight over longer periods of time.

From a theoretical perspective, guided imagery may impact self-efficacy and motivation (Duncan et al., 2012; Giacobbi et al., 2014a, b; Teixeira et al., 2012) to initiate or maintain exercise behavior. Previous research also suggests that imagery use before or during exercise may increase positive affective states that result from exercise, thereby increasing the likelihood that individuals will maintain this behavior over time (Stanley & Cumming, 2010). It is possible users of guided imagery increase their autonomous motivation to exercise and self-efficacy because they have developed a new skill. Pending further testing of guided imagery with diverse populations, this cognitive technique might be used to help individuals maintain exercise behavior longer periods of time than observed here.

With regard to food cravings, our finding that imagery targeted to specific foods that were craved by women confirms previous work (Morewedge et al., 2010) and may be construed as paradoxical. Convention wisdom would suggest that imagining oneself eating a particular food would lead to increased craving and desire for that food and, therefore, should be avoided if one has concerns about overeating. Likewise, there is much research using imagery as an avoidant mechanism. Previous research has shown that when individuals crave a desired food they report vivid images of these foods (May et al., 2008; Tiggemann & Kemps, 2005). Laboratory studies have shown that experimentally manipulating imagery with competing sensory information or distractions can reduce cravings. These may include images of non-food related (E. Kemps & Tiggemann, 2007), modeling clay (Andrade et al., 2012), playing a video game (Skorka-Brown et al.,2014), or engaging in hand or eye movements (Kemps& Tiggemann,2007;McClelland et al., 2006).

The distraction or avoidant-oriented use of imagery described above is in contrast to our approach which could be characterized as an approach or acceptance-based model of coping with food cravings. From this perspective, we hypothesize that imagining a food that is frequently craved would result in perceptions of satiety which then reduces urges or cravings for that food. While both avoidant and approach-oriented guided imagery approaches may be effective at reducing food cravings, the empirical questions regarding how and why food cravings change after exposure to guided imagery using both approaches appear vast. There may also be individual differences in preferences for approach versus avoidant use of guided imagery as a mechanism to cope with food cravings.

The highly translatable nature of telephone interventions adds to the importance of this study. Previous systematic reviews have supported the use of telephone interventions to reduce body weight (Goode et al., 2012). While some of the telephone-based studies reviewed by Goode and colleagues used cognitive-behavioral techniques, we are not aware of any that relied primarily on guided imagery. Pending more evidence, this cognitive technique may offer an additional strategy to enhance efforts or assist individuals with weight loss that can be readily adopted by medical and other health practitioners. Indeed, insurance sponsored telephone-based programs are one possibility for dissemination of

Author Manuscript
Author Manuscript
Author Manuscript

guided imagery interventions and our team is aware of one such model (Abildso et al., 2013).

The non-significant findings regarding exercise motivation are worthy of discussion. While our findings contradict previous randomized trials that showed significant changes in self-determined motivation to exercise using the EMS and the scoring method employed here (Buman et al., 2011; Giacobbi et al., 2014a), b), the descriptive trends were encouraging. Methodologically speaking, the intervention delivery agents used by Giacobbi et al., (2014a, b) were age and gender matched peers while Buman et al. (2011) utilized male and female peers to work as mentors with mixed gender groups of older adults. Importantly, intervention delivery in both these investigations was inperson while the present study relied predominantly on a telephone-based model. It is possible that in-person administration of guided imagery intervention is more likely to nurture autonomous exercise motives compared to telephone delivery because of the interpersonal nature of the former.

While positive changes were observed in food cravings and exercise behavior, non-significant changes in perceived stress were somewhat surprising. Anecdotal evidence during and after the intervention revealed that participants enjoyed and reported benefitting from the stress/relaxation script. For example, several women reported to their health educators during weekly telephone conversations that they used this script in the evening prior to bedtime, while the food craving and exercise scripts were most often used during the day. Accounts about the stress/relaxation script were generally positive, which would seem to warrant further research in order to understand if and how guided imagery can decrease perceived stress with overweight and obese women. Targeting psychological stress using guided imagery in the manner prescribed here was intended to be a familiar way to introduce this skill and help participants understand how it is used to address other health behaviors such as food cravings and physical activity.

Study limitations and future research

While the study findings are positive, several shortcomings should be noted. First, the survey measures used in this study, while valid and reliable, are prone to self-report biases. Future researchers could test the impact of guided imagery using more objective measures, such as assessments of stress cortisol, activity monitors, structured assessments of dietary behavior, and changes in body weight. These procedures were not possible here due to the preliminary nature of this research program but are clearly justified in the future. Second, the small sample size and relatively brief duration of the intervention were also due to limited resources. Although the brevity of the intervention could be viewed as a strength due to the limited burden placed on participants, it would not be safe or feasible to focus on changes in body weight for such a short intervention. Therefore, future interventions should recruit a greater number of participants and focus on changes in body mass index or composition over longer periods of time. Finally, the use of a wait-list control group could have introduced bias in the results as participants randomized to wait six-weeks may have had expectations of changing their behaviors since they did not receive treatment. It was also possible that the wait-list participants may have sought other information or changed their diet and exercise behavior even though they were instructed to maintain these behaviors as usual. However, we tried to minimize any potential biases by not having contact with wait-listed participants until they began participation in the study.

Conclusions

Results of this multi-behavior intervention generally support the acceptability and feasibility of guided imagery to address psychological stress, food cravings, and physical activity behavior with overweight and obese women. Future research is justified that uses guided imagery to address multiple health behaviors generally and the outcomes studied here specifically.

Acknowledgements

This publication is a product of the West Virginia Prevention Research Center and was supported by Cooperative Agreement Number 1-U48-DP-005004 from the Centers for Disease Control and Prevention. The findings and conclusions in this article are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

References

Abildso CG, Zizzi S, & Fitzpatrick SJ (2013). Predictors of clinically significant weight loss and participant retention in an insurance-sponsored community-based weight management program. Health Promot Pract, 14(4), 580–588. doi:10.1177/1524839912462393 [PubMed: 23075503]

Alberts HJEM, Thewissen R, & Raes L (2012). Dealing with problematic eating behaviour. The effects of a mindfulness-based intervention on eating behaviour, food cravings, dichotomous thinking and body image concern. Appetite, 58(3), 847–851. doi:10.1016/j.appet.2012.01.009 [PubMed: 22265753]

Andersson EK, & Moss TP (2011). Imagery and implementation intention: A randomised controlled trial of interventions to increase exercise behaviour in the general population. Psychology of Sport and Exercise, 12, 63–70. doi:10.1016/j.psychsport.2010.07.004

Andrade J, Pears S, May J, & Kavanagh DJ (2012). Use of a clay modeling task to reduce chocolate craving. Appetite, 58(3), 955–963. doi:10.1016/j.appet.2012.02.044 [PubMed: 22369958]

Bhutani GE (2015). Looking after me looking after you: Using positive cognitive behavioural techniques to improve emotional well-being. The Cognitive Behaviour Therapist. doi:10.1017/S1754470X15000227

Bigham E, McDannel L, Luciano I, & Salgado-Lopez G (2014). Effect of a brief guided imagery on stress. Biofeedback, 42(1), 28–35. doi:10.5298/1081-5937-42.1.07

Bishop FL, Yardley L, & Lewith GT (2007). A systematic review of beliefs involved in the use of complementary and alternative medicine. Journal of Health Psychology, 12(6), 851–867. doi:10.1177/1359105307082447 [PubMed: 17956965]

Buman MP, Giacobbi PR Jr., Dzierzewski JM, Aiken Morgan A, McCrae CS, Roberts BL, et al. (2011). Peer volunteers improve long-term maintenance of physical activity with older adults: A randomized controlled trial. Journal of Physical Activity Health, 8(Suppl 2), S257–S266.

Casement MD, & Swanson LM (2012). A meta-analysis of imagery rehearsal for post-trauma nightmares: Effects on nightmare frequency, sleep quality, and posttraumatic stress. Clinical Psychology Review, 32(6), 566–574. doi:10.1016/j.cpr.2012.06.002 [PubMed: 22819998]

Chan CK, & Cameron LD (2012). Promoting physical activity with goal-oriented mental imagery: A randomized controlled trial. Journal of Behavioral Medicine, 35(3), 347–363. doi:10.1007/s10865-011-9360-6 [PubMed: 21695405]

Chao A, Grilo CM, White MA, & Sinha R (2015). Food cravings mediate the relationship between chronic stress and body mass index. Journal of Health Psychology, 20(6), 721–729. doi:10.1177/1359105315573448 [PubMed: 26032789]

Cohen S, Kamarck T, & Mermelstein R (1983). A global measure of perceived stress. Journal of Health and Social Behavior, 24, 386–398.

Deci EL, & Ryan RM (1985). Intrinsic motivation and self-determination in human behavior. Berlin: Springer.

Duncan LR, Hall CR, Wilson PM, & Rodgers WM (2012). The use of a mental imagery intervention to enhance integrated regulation for exercise among women commencing an exercise program. Motivation and Emotion, 36(4), 452–464. doi:10.1007/s11031-011-9271-4

Emmons KM, McBride CM, Puleo E, Pollak KI, Clipp E, Kuntz K, et al. (2005). Project PREVENT: A randomized trial to reduce multiple behavioral risk factors for colon cancer. Cancer Epidemiology, Biomarkers & Prevention, 14(6), 1453–1459. doi:10.1158/1055-9965.epi-04-0620

Finkelstein EA, Trogdon JG, Cohen JW, & Dietz W (2009). Annual medical spending attributable to obesity: Payer-and service-specific estimates. Health Affairs (Millwood), 28(5), w822–w831. doi:10.1377/hlthaff.28.5.w822

Flegal KM, Carroll MD, Kit BK, & Ogden CL (2012). Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999–2010. JAMA, 307(5), 491–497. doi:10.1001/jama.2012.39 [PubMed: 22253363]

Furnham A, Vincent C, & Wood R (1995). The health beliefs and behaviors of three groups of complementary medicine and a general practice group of patients. Journal of Alternative and Complementary Medicine, 1, 347–359. doi:10.1089/acm.1995.1.347 [PubMed: 9395630]

Geller K, Lippke S, & Nigg CR (2016). Future directions of multiple behavior change research. Journal of Behavioral Medicine. doi:10.1007/s10865-016-9809-8

Giacobbi PR Jr., Buman MP, Dzierzewski J, Aiken-Morgan AT, Roberts B, Marsiske M, et al. (2014a). Content and perceived utility of mental imagery by older adults in a peer-delivered physical activity intervention. J Appl Sport Psychol, 26(2), 129–143. doi:10.1080/10413200.2013.803502 [PubMed: 25067894]

Giacobbi PR Jr., Dreisbach KA, Thurlow NM, Anand P, & Garcia F. (2014b). Mental imagery increases self-determined motivation to exercise with university enrolled women: A randomized controlled trial. Psychology of Sport and Exercise, 15, 374–381. doi:10.1016/j.psychsport.2014.03.004

Giacobbi PR Jr., Stabler ME, Stewart J, Jaeschke A-M, Siebert J, & Kelley G. (2015). Guided imagery for arthritis and other rheumatic diseases: A systematic review of randomized controlled trials. Pain Mangement Nursing, 16(5), 792–803. doi:10.1016/j.pmn.2015.01.003

Godin G, & Shephard RJ (1985). A simple method to assess exercise behavior in the community. Canadian Journal of Applied Sport Science, 10, 141–146.

Goode AD, Reeves MM, & Eakin EG (2012). Telephone-delivered interventions for physical activity and dietary behavior change: An updated systematic review. American Journal of Preventive Medicine, 42(1), 81–88. doi:10.1016/j.amepre.2011.08.025 [PubMed: 22176852]

Hawkes AL, Chambers SK, Pakenham KI, Patrao TA, Baade PD, Lynch BM, et al. (2013). Effects of a telephone-delivered multiple health behavior change intervention (CanChange) on health and behavioral outcomes in survivors of colorectal cancer: A randomized controlled trial. Journal of Clinical Oncology, 31(18), 2313–2321. doi:10.1200/jco.2012.45.5873 [PubMed: 23690410]

Hawkes AL, Patrao TA, Green A, & Aitken JF (2012). CanPrevent: A telephone-delivered intervention to reduce multiple behavioural risk factors for colorectal cancer. BMC Cancer, 12, 560. doi:10.1186/1471-2407-12-560 [PubMed: 23181756]

Holmes EA, Arntz A, & Smucker MR (2007). Imagery rescripting in cognitive behaviour therapy: Images, treatment techniques and outcomes. Journal of Behavior Therapy and Experimental Psychiatry, 38(4), 297–305. doi:10.1016/j.jbtep.2007.10.007 [PubMed: 18035331]

Jacobs DR, Ainsworth BE, Hartman TJ, & Leon AS (1993). A simultaneous evaluation of 10 commonly used physical-activity questionnaires. Medicine and Science in Sports and Exercise, 25(1), 81–91. doi:10.1249/00005768-199301000-00012 [PubMed: 8423759]

Kemps E, & Tiggemann M. (2007). Modality-specific imagery reduces cravings for food: An application of the elaborated intrusion theory of desire to food craving. Journal of Experimental Psychology Applied, 13(2), 95–104. doi:10.1037/1076898x.13.2.95 [PubMed: 17535134]

Kemps E, & Tiggemann M. (2014). A role for mental imagery in the experience and reduction of food cravings. Frontiers in Psychiatry. doi:10.3389/fpsyt.2014.00193

Knauper B, McCollam A, Rosen-Brown A, Lacaille J, Kelso E, & Roseman M. (2011). Fruitful plans: Adding targeted mental imagery to implementation intentions increases fruit consumption. Psychology and Health, 26(5), 601–617. doi:10.1080/08870441003703218 [PubMed: 21337259]

Li F. (1999). The exercise motivation scale: Its multifaceted structure and construct validity. Journal of Applied Sport Psychology, 11, 97–115. doi:10.1080/10413209908402953

Mason AE, Epel ES, Aschbacher K, Lustig RH, Acree M, Kristeller J, et al. (2016). Reduced reward-driven eating accounts for the impact of a mindfulness-based diet and exercise intervention on weight loss: Data from the SHINE randomized controlled trial. Appetite, 100, 86–93. doi:10.1016/j.appet.2016.02.009 [PubMed: 26867697]

May J, Andrade J, Kavanagh D, & Penfound L. (2008). Imagery and strength of craving for eating, drinking, and playing sport. Cognition and Emotion, 22(4), 633–650. doi:10.1080/02699930701446296

Mc Sharry J, Olander EK, & French DP (2015). Do single and multiple behavior change interventions contain different behavior change techniques? A comparison of interventions targeting physical activity in obese populations. Health Psychology, 34(9), 960–965. doi:10.1037/hea0000185 [PubMed: 25528182]

McClelland A, Kemps E, & Tiggemann M. (2006). Reduction of vividness and associated craving in personalized food imagery. Journal of Clinical Psychology, 62(3), 355–365. doi:10.1002/jclp.20216 [PubMed: 16299713]

Missbach B, Florack A, Weissmann L, & König J. (2014). Mental imagery interventions reduce subsequent food intake only when self-regulatory resources are available. Frontiers in Psychology. doi:10.3389/fpsyg.2014.01391

Morewedge CK, Huh YE, & Vosgerau J. (2010). Thought for food: Imagined consumption reduces actual consumption. Science, 330(6010), 1530–1533. doi:10.1126/science.1195701 [PubMed: 21148388]

Nichol J, Thompson EA, & Shaw A. (2011). Beliefs, decision-making, and dialog about complementary and alternative medicine (CAM) within families using CAM: A qualitative study. Journal of Alternative and Complementary Medicine, 17(2), 117–125. doi:10.1089/acm.2010.0171 [PubMed: 21299428]

Nijs IMT, Franken IHA, & Muris P. (2007). The modified trait and state food-cravings questionnaires: Development and validation of a general index of food craving. Appetite, 49(1), 38–46. doi:10.1016/j.appet.2006.11.001 [PubMed: 17187897]

Ogden CL, Carroll MD, Kit BK, & Flegal KM (2012). Prevalence of obesity and trends in body mass index among us children and adolescents, 1999–2010. JAMA, 307(5), 483–490. doi:10.1001/jama.2012.40 [PubMed: 22253364]

Potenza MN, & Grilo C. (2014). How relevant is food craving to obesity and its treatment? Frontiers in Psychiatry. doi:10.3389/fpsyt.2014.00164

Ryan RM, & Deci EL (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and wellbeing. American Psychologist, 55(1), 68–78. doi:10.1037/0003066X.55.1.68 [PubMed: 11392867]

Ryan RM, Patrick H, Deci EL, & Williams GC (2008). Facilitating behavior change and its maintenance: Interventions based on self-determination theory. The European Health Psychologist, 10, 2–5.

Schiller JS, Lucas JW, Ward BW, & Peregoy JA (2012). Summary health statistics for U.S. adults: National Health Interview Survey, 2010. Vital Health Statistics, 10(252).

Silva MN, Vieira PN, Coutinho SR, Minderico CS, Matos MG, Sardinha LB, et al. (2010). Using self-determination theory to promote physical activity and weight control: A randomized controlled trial in women. Journal of Behavioral Medicine, 33, 110–122. doi:10.1007/s10865-009-9239 [PubMed: 20012179]

Skorka-Brown J, Andrade J, & May J. (2014). Playing 'Tetris' reduces the strength, frequency and vividness of naturally occurring cravings. Appetite, 76, 161–165. doi:10.1016/j.appet.2014.01.073 [PubMed: 24508486]

Spring B, Moller AC, & Coons MJ (2012). Multiple health behaviours: Overview and implications. Journal of Public Health, 34(Suppl 1), i3–i10. doi:10.1093/pubmed/fdr111 [PubMed: 22363028]

Stanley DM, & Cumming J. (2010). Are we having fun yet? Testing the effects of imagery use on the affective and enjoyment responses to acute moderate exercise. Psychology of Sport and Exercise, 11, 582–590. doi:10.1016/j.psychsport.2010.06.010

Teixeira PJ, Carraca EV, Markland D, Silva MN, & Ryan RM (2012). Exercise, physical activity, and self-determination theory: A systematic review. International Journal of Behavioral Nutrition and Physical Activity, 9(78), http://www.ijbnpa.org/content/9/1/78

Thomas NJT (2016). Mental Imagery: The Stanford Encyclopedia of Philosophy In Zalta EN (Ed.), The Stanford Encyclopedia of Philosophy (Summer, 2016 ed.): Center for the Study of Language and Information Retrieved from http://plato.stanford.edu/archives/sum2016/entries/mental-imagery

Tiggemann M, & Kemps E. (2005). The phenomenology of food cravings: The role of mental imagery. Appetite, 45(3), 305–313. doi:10.1016/j.appet.2005.06.004 [PubMed: 16112776]

US Department of Health and Human Services. (2008). Physical activity guidelines advisory committee report 2008. Retrieved from http://www.health.gov/paguidelines/committeereport.aspx

van Berkel J, Boot CRL, Proper KI, Bongers PM, & van der Beek AJ (2014). Effectiveness of a worksite mindfulnessbased multi-component intervention on lifestyle behaviors. The International Journal of Behavioral Nutrition and Physical Activity. doi:10.1186/1479-5868-11-9

Vander Wal JS, Johnston KA, & Dhurandhar NV (2007). Psychometric properties of the State and Trait Food Cravings Questionnaires among overweight and obese persons. Eating Behaviors, 8(2), 211–223. doi:10.1016/j.eatbeh.2006.06.002 [PubMed: 17336791]

Verkaik R, Busch M, Koeneman T, van den Berg R, Spreeuwen-berg P, & Francke AL (2014). Guided imagery in people with fibromyalgia: A randomized controlled trial of effects on pain, functional status and self-efficacy. Journal of Health Psychology, 19(5), 678–688. doi:10.1177/1359105313477673 [PubMed: 23520350]

Wininger SR (2007). Self-determination theory and exercise behavior: An examination of the psychometric properties of the exercise motivation scale. Journal of Applied Sport Psychology, 19, 471–486.

World Health Organization. (2010). Global recommendations on physical activity and health. Geneva, Switzerland: World Health Organization.

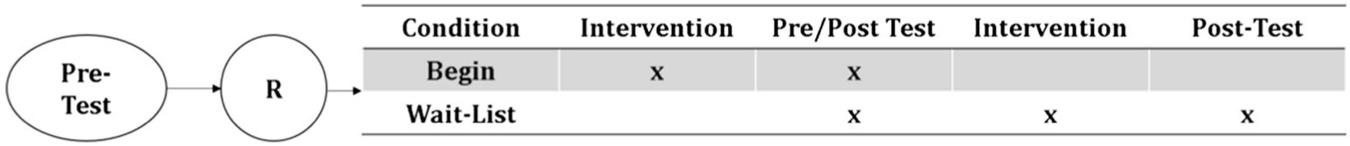

Fig. 1.
Study design

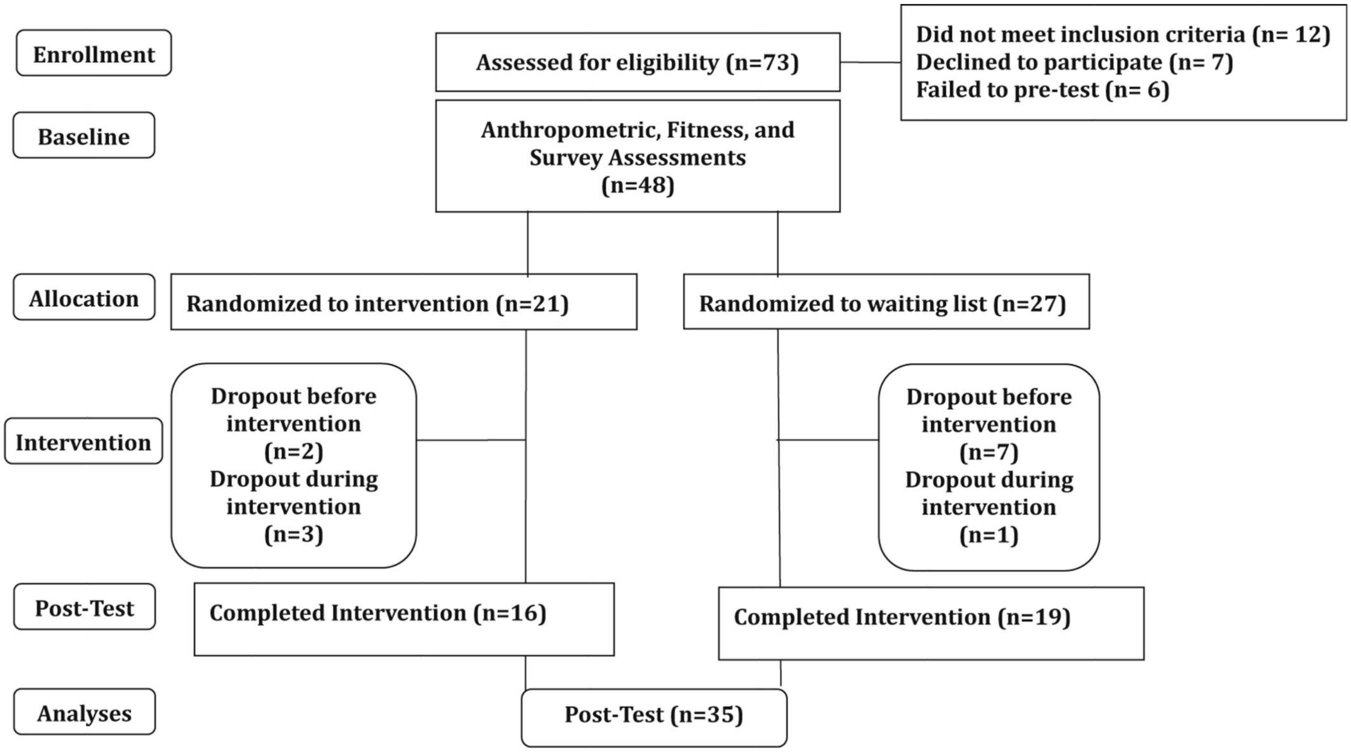

Fig. 2.
Participant flow through the imagery intervention

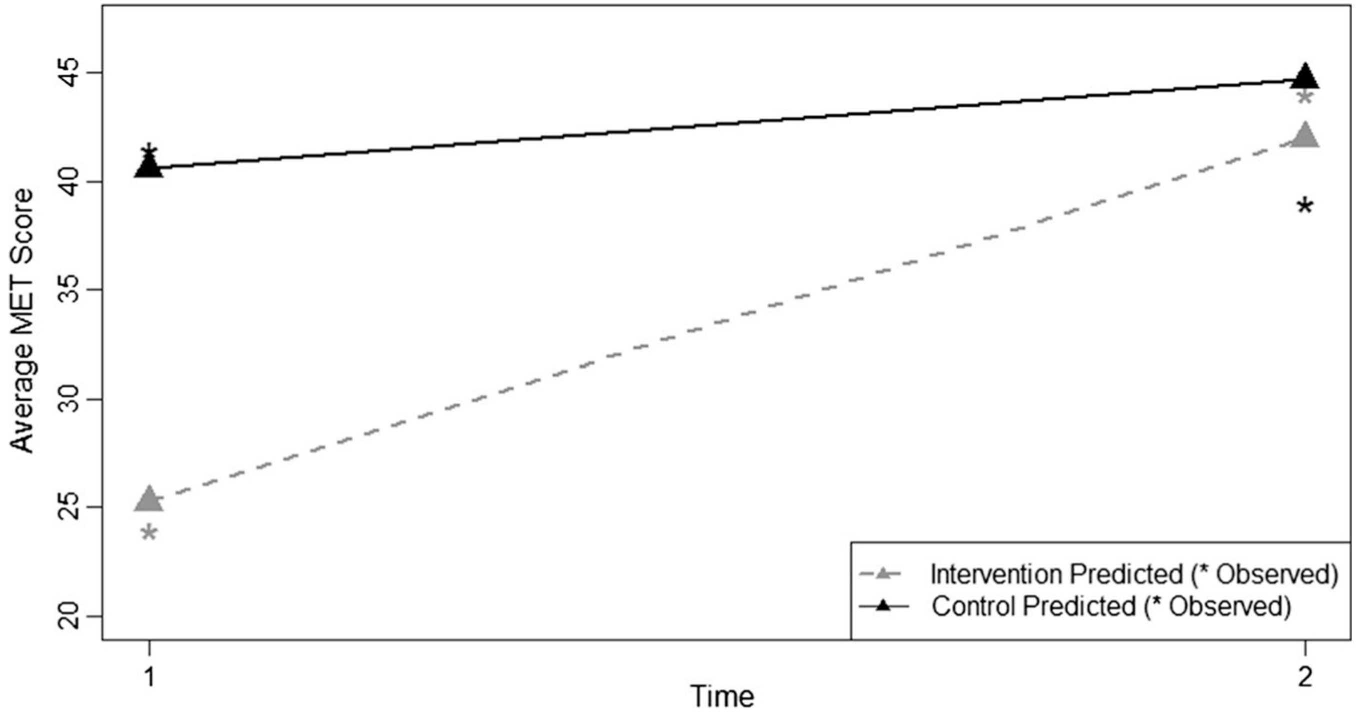

Fig. 3.
Group-by-time interaction for MET estimates. *MET* metabolic expenditure from exercise behavior

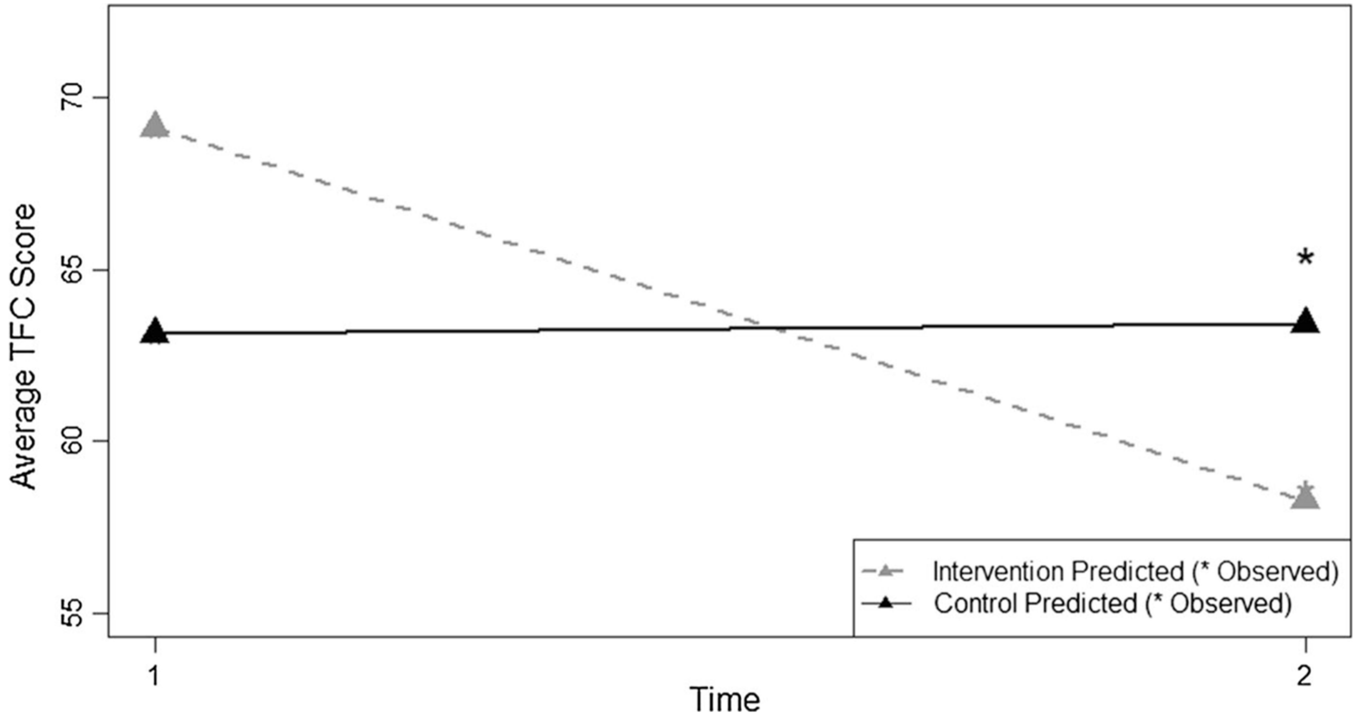

Fig. 4.
Group-by-Time Interaction for Trait Food Cravings. TFC trait food cravings

Table 1

Baseline Measures: Mean (Standard Deviation)

Variable	Wait-list	Intervention
Age	43.7 (12.9)	47.9 (7.9)
BMI	30.9 (8.9)	32.1 (6.9)
MET	41.4 (28.5)*	24.0 (22.0)
Food Cravings	63.1 (18.5)	69.1 (18.6)
Perceived Stress	16.1 (6.8)	14.6 (6.5)
Exercise Motivation	71.81 (25.41)	61.11 (25.44)

BMI body mass index, *MET* metabolic expenditure

* $P < 05$

Table 2

Linear mixed effects models adjusting for group, baseline exercise, and group plus baseline exercise

	Model 1: adjusting for group		
Outcome	**Estimate**	**95% C.I.**	***P* value**
Exercise			
Interaction	12.63	(2.48, 22.77)	0.0167
Time	4.11	(−2.78, 11.01)	0.2311
Group	−15.33	(−30.75, 0.08)	0.0512
Baseline exercise	–	–	–
Trait food cravings			
Interaction	−11.12	(−20.58, −1.66)	0.0225
Time	0.27	(−6.19, 6.73)	0.9331
Group	5.99	(−4.22, 16.20)	0.2418
Baseline exercise	–	–	–
Exercise motivation			
Interaction	9.28	(−1.21, 19.76)	0.0811
Time	0.22	(−6.77, 7.21)	0.9502
Group	−19.65	(−39.67, 0.36)	0.0541
Baseline exercise	–	–	–

Outcome	Model 2: adjusting for baseline exercise			Model 3: adjusting for baseline exercise and group		
	Estimate	**95% C.I.**	***P* value**	**Estimate**	**95% C.I.**	***P* value**
Trait food cravings						
Interaction	−9.51	(−18.93, −0.08)	0.0481	−10.73	(−21.24, −0.21)	0.0458
Time	−0.84	(−7.53, 5.84)	0.7985	−0.29	(−7.32, 6.75)	0.9347
Group	–	–	–	2.84	(−7.87, 13.54)	0.5927
Baseline exercise	−0.14	(−0.31, 0.03)	0.1062	−0.13	(−0.31, 0.06)	0.1686

C.I. confidence interval