

Outcomes of Home-Prepared Food Consumption Following a 16-Week Internet-Based Weight Loss Intervention

by

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Background: Research has shown that fast food, restaurants, and other away-from-home food sources are associated with a higher intake of calories, saturated fat, total fat, and an increased body mass index (BMI). Despite this, there has been a continuous shift from foods prepared at home to away-from-home sources with approximately one-third of daily energy intake stemming from fast-food outlets and restaurants. Alternatively, research has shown that increased food preparation is associated with an increased likelihood of meeting dietary objectives, improved overall health and survival, and decreased BMI.

Purpose: The purpose of this study was to examine the association among home-prepared meal consumption outside of the home and weight outcomes following a 16-week, self-administered weight loss intervention using ecological momentary assessment. Further, this study also examined individual differences (i.e., health consciousness, food/health literacy, motivations, barriers) associated with home-food preparation behaviors.

Methods: Forty-seven participants (79.6% female, 59.2% Caucasian) enrolled in a 16-week, self-administered online weight loss intervention. Participants completed

baseline measures during the initial orientation to the intervention, as well as ecological momentary assessments of dietary behaviors during the first two weeks of the intervention. Correlational analyses examined the relationship among weight loss, home-prepared food consumption, health consciousness, and health literacy. Paired-sample t-tests and hierarchical linear modeling examined perceptions related home-prepared food consumption while analyses of variance were used to examine motivations and barriers related to home-prepared food consumption.

Results: The relationship between weight loss and health consciousness, health literacy, and home-prepared food consumption did not meet the conventional standards of statistical significance. There was, however, a moderate effect size ($r = -.455$, $p = .077$) between home-prepared food consumption and weight loss. Individuals demonstrated greater perceptions of goal consistency, diet success, and diet maintenance during eating episodes when consuming home-prepared food, though overall consumption of home-prepared food did not predict feelings of success and maintenance with one's diet. Saving money and eating healthier appeared to be the greatest motivators to consuming home-prepared food, while time constraints and social interactions pose the greatest barriers to preparing and consuming home-made food.

Discussion: The results of this study suggest that consumption of home-made food may be a successful predictor of weight loss following an internet-based self-help weight loss intervention. Further research on behaviors and perceptions related to food preparation with a larger and more diverse sample is needed to determine the utility of these factors in future weight loss interventions.

OUTCOMES OF HOME-PREPARED FOOD CONSUMPTION FOLLOWING A 16-
WEEK INTERNET-BASED WEIGHT LOSS INTERVENTION

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INTRODUCTION

Obesity

Approximately 70% of Americans aged 20 years and older are overweight (National Center for Health Statistics, 2016) with obesity exceeding 35 percent in most sex and age groups (Flegal, Carroll, Ogden, & Curtin, 2010). The overall burden associated with overweight and obesity is a public health concern due to the significant impact on health outcomes; increases in body mass index (BMI) are a major risk factor associated with the onset and progression of numerous chronic illnesses such as type 2 diabetes (Kahn, Hull, & Utzschneider, 2006), hypertension and chronic kidney disease (Hall et al., 2014), cardiovascular disease (Lavie, Milani, & Ventura, 2009), and several forms of cancer (De Pergola & Silvestris, 2013). The total annual cost of health care associated with overweight and obesity exceeds \$147 billion (Finkelstein, Trogdon, Cohen, & Dietz, 2009) with an increase in total health care for each unit increase in BMI (Tigbe, Briggs, & Lean, 2012). Individuals with obesity (BMI > 30) accrue costs approximately 30 percent higher than normal weight individuals (BMI < 25; Withrow & Alter, 2011). In addition, the overall health burden associated with obesity has consistently risen among US adults since 1993 having surpassed smoking as the greatest contributor to disease and quality of life years lost in adults (Jia & Lubetkin, 2010). Further, approximately 400,000 deaths occur each year that are attributable to poor diet, overweight and obesity, and a conservative estimate predicts this number will increase by an additional 15,000 every year (Mokdad, Marks, Stroup, & Gerberding, 2004). Research has attributed the large increases in overweight and obesity throughout the past several decades to increases in total caloric intake over long periods of time (Swinburn et al., 2009).

Behavioral Weight Loss Interventions

Behavioral weight loss interventions are considered the standard for the treatment of overweight and mild to moderate obesity (Wing & Phelan, 2005). Such interventions are traditionally delivered in a group format and led by a trained health professional with a goal of targeting areas such as dietary behaviors, physical activity, and social support. Research has shown that as little as a 5% loss of total body weight can significantly reduce the health risks associated with overweight and obesity (Jensen et al., 2014). A systematic review of 80 clinical weight loss trials found that interventions including food and meal planning strategies resulted in a mean weight loss of approximately 5% to 9% of total body weight 6-months after baseline (Franz et al., 2007).

Despite the benefits associated with traditional behavioral weight loss interventions, the reach of these in-person methods are limited. Additionally, these methods place excessive burden on treatment participants due to the potential needs for travel time, work absence, and costs of program participation (Krukowski, Mick Tilford, Harvey-Berino, & West, 2011). Further, accessibility to weight loss programs can pose a challenge as interventions can be costly or limited to university or research facilities. As the prevalence and magnitude of obesity has led to an increased need for healthcare resources, more efficient treatment modalities are greatly needed. Self-help approaches to weight loss have been recommended as cost-effective, time-efficient, and easily accessible alternatives to the burdens associated with traditional in-person weight loss programs (Latner & Wilson, 2007). Self-administered weight loss treatments offer limited or no professional contact beyond an introductory face-to-face

orientation to provide participants with screening procedures and materials (Tang, Abraham, Greaves, & Nikolaou, 2016). These interventions are self-directed through topics such as dietary, physical activity, and weight loss goals, and education on nutrition, exercise, calorie monitoring and other behavioral strategies.

Early support for home-based self-administered weight loss interventions has been established utilizing paper materials and manuals. A randomized control design assessing the efficacy of a home-based weight loss intervention found that the self-administered at-home condition was equally as effective as the clinic-based condition in promoting weight loss (Leermakers, Jakicic, Viteri, & Wing, 1998). Further, a systematic review highlighted that self-administered interventions are an effective delivery format for promoting weight loss, with participants losing an average of 3.44 lbs. more than minimal intervention or no-treatment control groups, and when augmented with personal contact, can produce greater weight loss outcomes (Tang et al., 2016).

Advancements in technology have enabled the delivery of self-administered weight loss interventions through internet and computer platforms such as emails (Gabriele, Carpenter, Tate, & Fisher, 2011) and websites (Arem & Irwin, 2011). Relative to traditional in-person programs, internet-based weight loss interventions are considered less burdensome on time and resources, are able to utilize similar tools that have been successful for traditional in-person programs, and have the potential to reach large populations (Arem & Irwin, 2011). Moreover, self-administered internet-based weight loss interventions can be adapted from traditional in-person, manual-based materials to provide personalized feedback that targets participant weight loss progress,

individual behavior change, and physical and dietary activity levels (Sherrington et al., 2016). In fact, self-administered interventions with tailored feedback have been shown to be effective, losing an average of 4.69 lbs. more than interventions lacking personalized feedback.

Further, research has demonstrated the efficacy of internet-based programs to achieve clinically significant weight loss. A systematic review of internet-based interventions found that this approach is capable of achieving an average weight loss ranging between 1.30 lbs. to 11.68 lbs. (Tang et al., 2016), with participants from manual-based programs losing substantially more weight (J. Tang, Abraham, Greaves, & Yates, 2014). In addition, internet-based interventions have shown to be cost-effective compared to traditional weight loss treatment. The estimated cost of a 6-month internet-based intervention at \$372 per person compared to \$706 for in-person treatment (Krukowski et al., 2011). Thus, internet-based weight loss interventions can produce clinically significant weight loss, and provide a cost-effective and easily accessible alternative approach to traditional in-person interventions.

Role of Food

Food management and eating are an integral aspect of everyday life that are driven by social, cultural, physiological, psychological, and economic factors that influence weight status and health outcomes (Devine, 2005). Moreover, food literacy is an important determinant of individuals' daily food choices that is influenced by these factors. Food literacy is defined as a collection of inter-related knowledge, skills and behaviors required to plan, manage, select, prepare and eat food to meet needs and determine intake (Vidgen & Gallegos, 2014). This definition refers to qualities that

empower individuals, households, communities, or nations to protect diet quality through change and strengthen dietary resilience over time. In fact, the importance of food literacy on health outcomes is well-recognized as nutrition and eating behaviors are a central focus in behavioral weight loss interventions.

Improvement of food management skills (i.e., food planning, selection, preparation, and eating) through weight loss treatments enable individuals to make informed food choices in the achievement of personal goals related to health (Bisogni, Jastran, Shen, & Devine, 2005). In addition, food selection influences health maintenance, and the prevention and management of the numerous chronic diseases associated with overweight and obesity. For example, management of diabetes requires effective food management strategies to prevent hyper- and hypoglycemia, and the accompanying negative health consequences (i.e., retinopathy, neuropathy, kidney damage). Food choice is affected by an individual's food literacy, as well as their capacity to target and actively strive to achieve healthy eating strategies. Thus, the source of food and food management skills should be considered when targeting food literacy and dietary behaviors in behavioral weight loss interventions. This is especially relevant with the noticeable shift in the amount of food consumed away from the home.

Away-From-Home Meals

The source and composition of meals in the United States has drastically changed over the last several decades. There has been a continuous shift from foods prepared at home to away-from-home sources (Nielsen, Siega-Riz, & Popkin, 2002b) with approximately one-third of daily energy intake stemming from fast-food outlets and restaurants (Smith, Ng, & Popkin, 2013; Zick & Stevens, 2010). In fact, Fulkerson et al.

(2011) found that roughly half of families in a large sample reported purchasing fast-food, foods from full-service restaurants, and takeout at least once a week. A more recent study estimated that 70 percent of families purchased away-from-home food sources at least weekly (Kegler et al., 2014).

The shift in food source has accompanied critical changes in the types of foods consumed and the associated nutrient content. Consumption of away-from-home foods has increased the proportion of dietary intake from pizza, cheeseburgers, french fries and sugary beverages (Nielsen, Siega-Riz, & Popkin, 2002a) and is associated with a higher intake of calories per meal, fat and saturated fat, cholesterol, sodium, and decreases in fiber and calcium (Guthrie, Lin, & Frazao, 2002). Further, fast-food is higher in energy density (i.e., calories), has less health promoting and cancer preventing nutrients (e.g., vitamin A, carotene, Vitamin C), and is associated with decreased micronutrient intake and higher body mass index (BMI) than other away-from-home sources (e.g., sit-down restaurant, take-out, delivery, ready-made from the grocery store, convenience store; Bowman, Gortmaker, Ebbeling, Pereira, & Ludwig, 2014; Bowman & Vinyard, 2004). Using a nationally representative sample of people of all ages (i.e., birth to death), Bowman and Vinyard (2004) found that fast-food contributed more than one-third of individuals' dietary consumption of daily energy, total fat, and saturated fat. Further, families providing meals from fast-food outlets, restaurants, or takeout at least weekly were one and a half to two and a half times more likely to be overweight or obese compared to families who did not make such purchases (Fulkerson et al., 2011). Supporting this finding, Ayala et al. (2008) found that weekly visits to restaurants was associated with increased BMI in children and adults.

The local environment plays a critical role in individual's choice of food source. Research has demonstrated that increased exposure and perceived proximity to fast-food outlets, as well as self-reported unhealthy food neighborhoods is associated with increased odds of consuming fast-food, 2-to-3 higher odds of having a poorer quality diet (i.e., less fruits and vegetables, less whole grains, higher saturated fat; Moore, Diez Roux, Nettleton, & Jacobs, 2008; Moore, Diez Roux, Nettleton, Jacobs, & Franco, 2009) and an increased likelihood of consuming higher energy snacks (Elliston et al., 2016). Additionally, higher density of fast-food outlets is associated with a higher prevalence of overweight and obesity in local residents (Li et al., 2008). Indeed, several studies have highlighted the association between decreased food preparation and an increase in fast-food consumption (Appelhans et al., 2012; Bowman & Vinyard, 2004).

Away-from-home food sources extend beyond traditional fast-food outlets and restaurants. Convenience stores and grocery markets often advertise ready-meals as healthy alternatives (e.g., fat-free, sugar-free) to home-prepared meals. Ready-meals are convenient, complete meals that are prepared through external procedures and are crafted with the purpose of replacing a home-prepared meal (Costa, Dekker, Beumer, Rombouts, & Jongen, 2001). Though often depicted as healthy alternatives, consumption of ready-meals is associated with increased BMI (van der Horst, Brunner, & Siegrist, 2010). Thus, consumption of foods away-from-home suggests individuals are at an increased risk of poorer quality diet and overweight and obesity.

Home-Prepared Foods

As indicated above, fewer people today are cooking meals at home, spending less time preparing foods (Smith et al., 2013), and relying more on packaged

foods and ready-to-eat meals. In contrast to the consequences associated with consuming away-from-home foods, increased cooking has been linked to improved overall health and survival and decreased BMI (Kolodinsky & Goldstein, 2011; Smith et al., 2013). Not surprisingly, increased food preparation is associated with less frequent consumption of fast-food and an increased likelihood of meeting dietary objectives for fat, calcium, fruit, vegetables, and whole grains (Larson, Perry, Story, & Neumark-Sztainer, 2006; Monsivais, Aggarwal, & Drewnowski, 2014). Although discussions of home food preparation are abundant in the literature, a coherent definition of home-cooked food appears to be lacking.

An operational definition of home-prepared food appears to be complicated by the inclusion of manufactured and ready-made products into fresh ingredients prepared in the home. In other words, meals are often a mixture of home-prepared and pre-prepared or processed foods. In fact, research suggests homemade products are to some extent manufactured, produced, packaged, and distributed through market sources (Moisio, Arnould, & Price, 2004). To assist in defining home-prepared food, it is useful to consider what is defined as processed or commercially prepared; Park and Capps (1997) define commercially prepared food as items that are processed, do not require significant effort or skill prior to consumption, and save considerable time and energy prior to eating. Further, these foods can be considered ready-to-eat, ready-to-heat, or ready-to-cook. Foods not classified as convenience products are fresh, unprocessed food items such as meat, produce and eggs, or ingredient foods that are not or at least are not commonly prepared in the home such as flour, butter, spices and pasta (Traub & Odland, 1979). For the purpose of the current study, home-prepared

food is operationalized as a meal or snack prepared in the home using raw, unprocessed foods, fresh or frozen, including meat, fish, eggs, fruits, and vegetables. Home-prepared food includes minimally processed ingredient foods that are not commonly prepared in the home such as flour, sugar, spices, condiments, butter or margarine, pasta, and whole grains, as well as canned vegetables that do not include additional seasoning or sauce. Excluded from this operational definition are T.V. dinners and other premade microwaveable meals and side dishes (i.e., macaroni and cheese, vegetables in sauce), and boxed or frozen meals that require limited time, energy, and skill in preparation prior to consumption.

In addition to its impact on health, research has found that preparing food increases liking and consumption of the food (Dohle, Rall, & Siegrist, 2014). Further, self-preparation also increases the health salience of the food being prepared (Dohle, Rall, & Siegrist, 2015). Therefore, meal preparation, a core component of food literacy, may encourage or empower individuals to determine the health quality of foods through increased knowledge of meal ingredients during preparation. Moreover, planning meals, along with other behaviors such as tracking calories, tracking fat, and measuring food, have been found to be common tasks associated with successful weight loss (Kruger, Michels Blanck, & Gillespie, 2006; Wing & Phelan, 2005). Therefore, preparation of meals at home has the potential to increase awareness of ingredients and allow for easier tracking of nutrients that are essential for successful weight loss and improved overall health.

Home-Prepared Foods Away-From-Home

Promotion of home cooking and family meals in the home have increased support to reduce the consequences associated with obesity as away-from-home food consumption has increased (Lichtenstein & Ludwig, 2010; Popkin, 2010), however, people are spending more time away from home during traditional meal times due to work and other obligations (Devine et al., 2009). Therefore, interventions targeting consumption of home-cooked meals in the home may not be as effective due to competing responsibilities that result in more time spent outside of the home (e.g., work, errands, attending to children's recreational activities). Further, increased time spent away from home creates additional opportunities to eat less healthy foods. In fact, research has demonstrated approximately 50% decreased likelihood of successfully losing weight when eating outside of the home compared to individuals who do not experience such dietary barriers (Kruger et al., 2006).

As indicated earlier, self-preparation of food increases the awareness of ingredients in the meal being consumed (Dohle et al., 2015). In addition, research has highlighted the importance of home-prepared meals for weight control and reducing the likelihood of consuming away-from-home foods (Appelhans et al., 2012). Thus, increased frequency of home-prepared food consumption away-from-home has the potential to enhance dietary behaviors consistent with nutrition and weight loss goals. Given that food literacy is considered dynamic and highly contextual (Vidgen & Gallegos, 2014), it is important to stress the role of planning and management of food preparation as core components in weight loss interventions.

When individuals are forced to consume meals outside of the home they are likely to benefit from strategies designed to improve the healthiness of these meals. Food choice coping strategies are behavioral mechanisms to conceptualize and manage food selection in response to personal demands and responsibilities, stress and fatigue, time constraints, food and eating expectations, and dietary needs of others (Devine et al., 2009). Strategies include planning meals through cooking enough for leftovers, packing a lunch for work or cooking on days off, saving time by eating while working, preparing family meals with canned, frozen or boxed entrees or grabbing ready-made convenience food, and missing meals or overeating to account for a missed meal. An examination of food choice coping strategies among working parents found that approximately 60 percent of parents bring lunch to work to manage time constraints. However, the findings highlighted that family meals often came from sources other than home and did not include the source of lunches brought to work. Moore et al. (2009) noted that interventions aimed at reducing exposure to fast-food and eliciting individual behavior change are important for public health outcomes. Thus, targeting food preparation, as well as food choice coping strategies, could increase the consumption of home-prepared meals outside of the home and decrease the poor health outcomes associated with consuming away-from-home food sources. In light of public health concerns, it is critical to find ways to increase the consumption of healthy, nutrient dense foods for positive health outcomes despite the widespread availability of convenient, unhealthy foods in our communities. There is a need for better understanding of the environmental factors associated with consuming home-prepared meals away-from-home.

Barriers to Consuming Home-Prepared Foods

Research has identified numerous perceived barriers to weight loss and weight maintenance (Ló Pez-Azpiazu, Ngel Martínez-González, Kearney, Gibney, & Martínez, 1999; Sharifi, Mahdavi, & Ebrahimi-Mameghani, 2013). Among these, specific barriers to food preparation have been highlighted. For example, time is a critical component of food preparation, and presents a common barrier to healthy weight outcomes. Research has shown that healthier dietary behaviors (i.e., increased fruit and vegetable intake, fewer visits to fast-food restaurants) are significantly associated with more time spent preparing, cooking, and cleaning up from meals (Monsivais et al., 2014). However, research examining employed mothers' food environments demonstrated that time scarcity was the most common barrier experienced and disproportionately influenced food choice for them and their families (Jabs et al., 2007). Despite knowledge of nutritional content, mothers often resorted to providing fast-food for their children due to lack of energy or time to cook.

Moreover, time may lead individuals to rely on ordering takeout and buying fast-food at the expense of healthier options such as preparing home-cooked meals (Jabs & Devine, 2006). The culturally accepted adage that time-is-money has placed a price tag on Americans' availability to prepare home-cooked meals. Some economists have attributed the increase in weight status to the relationship between time and money (Chou, Grossman, & Saffer, 2004) suggesting that achieving goals favored by society (e.g., occupational success, financial status, etc.) may come at the expense of weight status and overall health. Thus, increasing labor market demands appear to pose a threat to the valuable time necessary to promote healthy outcomes.

As indicated earlier, food literacy is key determinant in the health and well-being of individuals and their surroundings. Food preparation, a core component of food literacy (Vidgen & Gallegos, 2014), may present an additional barrier to preparing home-cooked meals when knowledge and skill in this area are limited. Limited skills in food management and food choice capacity have been demonstrated in individuals who struggle with food and meal choice (Bisogni et al., 2005). For example, individuals with low levels of food management skill and food choice capacity were less likely to identify themselves as a good cook, enjoy cooking and keep food costs down, and expressed limited control over how food was acquired or prepared, the types of foods eaten, the timing and regularity of meals, and the settings in which food was consumed, respectively. Supporting this concept, a literature review of cooking and home food preparation interventions found cooking skills and knowledge to be primary barriers of dietary change (Reicks, Tofholz, Stang, & Laska, 2014).

In addition, prior research indicates the association between cooking skills and ready-made meal intake pose a barrier to consuming healthy home-prepared meals (van der Horst et al., 2010). Using a large sample, this study found cooking skills to be a strong predictor of ready-made meal consumption suggesting the lack of cooking ability coincides with less frequent consumption of home-prepared foods as well as increased weight status. In fact, processed and convenience foods are often considered superior alternatives for individuals who lack knowledge in meals planning, cooking skills, time, and recipes as ready-made meals are quick, do not require substantial cooking ability, and are abundantly available (Asp, 1999). This suggests,

perhaps, that higher consumption of convenience and other away-from-home food sources may be associated with limited cooking skill, as well as low food literacy.

Furthermore, social interactions pose an additional barrier to consuming home-prepared meals. Eating is often a culturally and socially involved behavior that plays a central role in family gatherings, holiday parties, and sporting events. A review of social modeling of eating found social influence to be a primary predictor of eating behavior (Cruwys, Bevelander, & Hermans, 2015), and increased odds of eating if food is readily available and others are observed eating (Elliston et al., 2016). This research suggests that social settings and the dietary behaviors of others may influence individuals' food selection despite nutritional and weight loss goals. In fact, one study noted that simply consuming foods in the homes of relatives, neighbors, and friends increases overall dietary intake and risk of obesity (Ayala et al., 2008).

In addition, social relationships alone have been associated with instability of personal food choices (Bisogni et al., 2005). The presence of others and their dietary behaviors may negatively impact an individual's intention to consume a healthy home-prepared meal. For example, a person may partake in a lunch gathering with coworkers or friends despite his or her intent to consume a meal that was prepared at home. Moreover, eating home-prepared or healthy meals may prove difficult if these behaviors do not correspond to social norms in that particular setting. For example, individuals with overweight or obesity could experience stigma for eating healthy or unhealthy foods that bring attention to their dietary behaviors. In fact, experiences of weight stigma are associated with increased psychological distress and disordered eating (O'Brien et al., 2016). Thus, social context, as well as the interactions with others

surrounding eating behaviors may interfere with nutritional goals and pose a barrier to preparing or consuming home-cooked foods.

Personal Characteristics

Research has demonstrated certain behaviors are better predictors of successful weight loss outcomes (Kruger et al., 2006; Monsivais et al., 2014; Wing & Phelan, 2005); however, it is unclear why some individuals engage in these positive health behaviors while others do not. Personal characteristics associated with health behaviors such as food preparation may shed light on individuals that are more likely to prepare and consume home-cooked meals and lose a clinically significant amount of total body weight following a behavioral weight loss intervention. Health consciousness, for example, may be a characteristic associated with increased consumption of home-prepared meals as individuals higher in health consciousness may be able to overcome barriers associated with weight status to achieve their desired weight. Health consciousness refers to the responsibility taken for one's own health in which nutrition and food intake are regarded as important and critical aspects of their health (Schifferstein & Oude Ophuis, 1998). Prior cross-sectional research has highlighted that health consciousness is a good predictor of healthy dietary and lifestyle behaviors (i.e., greater intake of fruits and vegetables, smoking status, alcohol consumption, seeking health-related information; Hearty, McCarthy, Kearney, & Gibney, 2007), and individuals higher in health consciousness are more likely to achieve and maintain a normal weight (Schifferstein & Oude Ophuis, 1998). Thus, health consciousness may be a successful predictor at differentiating individuals who engage in positive health behaviors such as preparing and consuming home-prepared food.

As indicated earlier, food preparation, as well as other skills required to manage food choice and consumption, are critical components of food literacy (Vidgen & Gallegos, 2014); however, the concept of food literacy is in the early stages of development with recent studies aimed at defining the concept and making the case for its potential impact on health and weight (Cullen, Hatch, Martin, Higgins, & Sheppard, 2015; Vidgen & Gallegos, 2014). Further, it has been suggested that food literacy may reflect an aspect of health literacy which has emerged as a potentially important social determinant of health (Hoffman-Goetz, Donelle, & Ahmed, 2014). Health literacy refers to a set of skills that people need to function effectively in the health care environment, which includes the ability to read and understand information (print literacy), speak and listen effectively (oral literacy), and measure blood glucose levels, adhere to medication regimens and interpret food labels (numeracy; Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011).

Although an assessment of food literacy does not exist, the Newest Vital Sign (Weiss et al., 2005) represents a food-related health literacy assessment; this measure requires individuals to respond to nutrition related questions using a standard nutrition label from an ice-cream container. Recently, a three-step, stepped-care weight loss intervention using the Newest Vital Sign found that individuals higher in health literacy were more likely to lose a clinically significant amount of weight, and were less likely to be stepped up (i.e., require more intensive treatment; Carels, Selensky, Rossi, Solar, & Hlavka, 2017) relative to individuals lower in health literacy. Further, a systematic review of health literacy found that individuals low in health literacy were less likely to understand nutrition labels (Berkman et al., 2011). It is proposed that high health

literacy more broadly, and food literacy more specifically, reflect knowledge and skills that enable individuals to take ownership of their health and well-being (Cullen et al., 2015) and may be an important predictor of home-food preparation.

In addition to health consciousness and food/health literacy, other motivations may exist that predict more frequent consumption of home-cooked foods. The higher prevalence of overweight and obesity among low-income areas (Flegal et al., 2010) suggests the price of healthful foods is a barrier to weight management. In fact, cost restraints have been associated with a reduced proportion of energy intake from fruit, vegetables, meat and dairy products, and an increased proportion from added fats and sugars (Drewnowski & Specter, 2004). However, more recent research has highlighted the affordability of healthy foods (Carlson & Frazão, 2014) which suggests consumption of home-prepared meals may be considered a cost-saving strategy for some. In fact, Bisogni et al. (2005) found that monitoring costs was a set of food management skills demonstrated by individuals who frequently prepared meals and avoided eating away-from-home. In addition, packing meals and drinks for work was employed to save money. Further, increased time spent preparing, cooking, and cleaning up meals in the home has been linked to a decrease in money spent on food away from home (Monsivais et al., 2014).

Ecological Momentary Assessment

While the research on food preparation and dietary behaviors is increasing, the majority of our understanding in these areas is subject to retrospective reporting of these situations or events. This type of research is both practical and valuable yet is limited in several ways. Recall of autobiographical memory may be distorted resulting

in biased responses due to temporal precedence and inferential interference (i.e., external cues and internal perceptions; Bradburn, Rips, & Shevell, 1987). Current mood states are also likely to influence the experiences recalled. Clark and Teasdale (1982) demonstrated that patients were able to retrieve more happy memories when less depressed compared to occasions when they were more depressed. In terms of dietary behaviors, emotions regarding food choice may limit participants' ability to recall the source and quantity of food during an eating episode. For example, if an individual engages in an emotional eating episode to cope with experiences of weight stigma, social pressures, or personal responsibilities, the salience of the emotions during the episode may skew the person's ability to retrospectively recall the nutritional content of the food.

Further, Bradburn et al. (1987) note that it is more difficult to recall autobiographical events when there are numerous comparable incidents; interference with later events may prevent an individual from identifying events similar in nature that occurred earlier. This skewed recall can be compounded when the behavior occurs several times a day. For example, an individual may be unable to differentiate the source of food during a particular week if he or she consumes meals from multiple sources on a daily basis (e.g., home, fast-food, etc.). Ecological momentary assessment (EMA) assists with overcoming issues with temporal recall of similar events by capturing behaviors as they occur in an individual's natural environment.

In one of the few studies designed to examine internal and external cues related to eating behavior, 51 overweight and obese adults completed an EMA entry following completion of a food log (Elliston et al., 2016). This study revealed that participants'

perceptions of proximity to fast-food restaurants increased the likelihood of consuming calorie-dense snacks and observing others eat increased the likelihood of eating. The findings of this study highlight importance of capturing momentary assessments of decisions related to dietary behaviors. Moreover, Kegler et al. (2014) suggest examining multiple settings in which dietary behaviors occur through an ecological approach.

The Current Study

Many studies have examined the association of food preparation and healthy dietary behaviors suggesting positive outcomes for health and weight status, yet research is limited on the consumption of home-prepared meals outside of the home. Existing research acknowledges gaps in the literature and propose examining the effects of regular food preparation in greater detail (Dohle et al., 2015). Further, Smith and colleagues (2013) highlight the need for additional research to determine the link between home-cooked foods and overall health. To my knowledge, only one study has focused on the momentary food environment (i.e., real-time in a natural setting) of dietary behaviors among adults with overweight and obesity (Elliston et al., 2016). However, this research did not examine the impact of home-prepared meals on health outcomes. Thus, the current study will utilize ecological momentary assessment to examine the association among home-prepared meal consumption outside of the home and weight outcomes following a 16-week self-administered weight loss intervention. An additional aim is to assess individual difference characteristics (i.e., health consciousness, motivations, barriers, health/food literacy) associated with home-food preparation behaviors.

Specific Aim one. Increased cooking and consumption of home-prepared foods has been shown to increase overall health and have a positive impact on weight status (Smith et al., 2013). In addition, research has shown that individuals preparing food at home appear to have greater awareness of ingredients of their food (Dohle et al., 2015), and consuming more home-prepared food may be coincide with perceptions of meeting nutrition goals compared to away-from-home sources. Thus, the first specific aim of this study to examine the association between home-prepared food consumption and weight loss and perceptions of meeting nutrition goals.

Hypothesis One. More frequent consumption of home-prepared meals will be associated with significantly greater weight loss following a 16-week self-administered weight loss intervention.

Hypothesis Two. More frequent consumption of home-prepared food will be associated with perceptions of meeting nutrition goals compared to food consumed from other sources.

Specific Aim Two. Research has highlighted the link between away-from-home meals and increased weight status (Fulkerson et al., 2011), as well as a decreased likelihood of losing weight when eating outside the home (Kruger et al., 2006). Thus, the second specific aim of this study is to examine the relationship between meals consumed outside the home and weight loss outcomes following the weight loss intervention.

Hypothesis Three. Greater frequency of meals consumed outside of the home (i.e., work, traveling, social gathering, etc.) will be significantly associated less weight loss following the 16-week self-administered weight loss intervention.

Specific Aim Three. The third specific aim of this study is to examine personal characteristics that may predict more frequent preparation and consumption of home-prepared food. Health consciousness has been demonstrated in individuals who successfully manage their weight as nutrition is regarded as critical for their health (Schifferstein & Oude Ophuis, 1998). Further, individuals' motivations and barriers may predict home-prepared food consumption and preparation. For example, individuals in this study may be more likely to report motivations of losing weight as they are enrolled in a weight loss intervention; on the other hand, research has shown that time (Jabs et al., 2007) and cooking skill and ability (van der Horst et al., 2010) are consistent barriers to healthy eating and are associated with more frequent consumption of away-from-home food. Thus, time may be the most frequently reported barrier, whereas cooking skill and ability may be predictive of levels of health consciousness.

Hypothesis Four. Participants higher in health consciousness will consume more home-prepared meals than participants lower in health consciousness.

Hypothesis Five. On average, individuals who consume home-prepared food outside the home will report greater motivations to lose weight compared to other motivations (i.e., save time, save money, or eat healthier).

Hypothesis Six. Time constraints will be associated with less frequent consumption of home-prepared food (at home or away from home) relative to other barriers.

Hypothesis Seven. Confidence in cooking abilities and knowledge of recipes will be associated with increased health consciousness compared to other barriers.

Specific Aim Four. The fourth specific aim of the study is to examine the relationship between health literacy and food preparation and weight loss outcomes. Individuals lower in health literacy have been shown to have difficulty understanding nutrition labels (Berkman et al., 2011) which suggests individuals higher in health literacy may consume more home-prepared food due to awareness of ingredients, calorie content, etc. Also, consistent with the literature, higher levels of health literacy may predict greater weight loss outcomes (Carels et al., 2017).

Hypothesis Eight. Participants higher in health literacy will be consume more home-prepared meals than individuals lower in health literacy.

Hypothesis Nine. Higher levels of health literacy will be associated with significantly greater weight loss following a 16-week self-administered weight loss intervention.

RESEARCH METHODS

Participants

The study sample consisted of 49 individuals (79.6% female) with MBMI = 36.71, SDBMI = 5.48 and age M = 41.08, SD = 12.10. Participants identified as Caucasian (59.2%), African American (26.5%), and Hispanic (4.1%). Inclusion criteria for the study were adults between 18 and 65 years old with a body mass index (BMI) of 27 or greater. This cutoff has been used in previous behavioral weight loss programs (Carels et al., 2009, 2017) and was chosen to allow for clinically significant weight loss for participants who would otherwise fall in the normal weight range (i.e., BMI < 25). Eligible individuals were required to have internet access at home, own a smartphone with a data plan, be interested in losing weight, and willing to download free mobile phone applications for monitoring nutrition and complete brief questionnaires. Exclusion criteria were women who were currently pregnant, planning to become pregnant within the next 6 months or breastfeeding, individuals who were currently following a specific dietary plan, had lost >10 pounds within the previous 6 months, and individuals who were currently self-monitoring their nutrition.

Recruitment and Screening

Participants were recruited through listserv announcements and screened online. A study advertisement was disseminated through two community email listservs that provided interested individuals with contact information for study staff. Study staff sent individuals a link to complete an eligibility pre-screening in the Redcap online data management system. Pre-screening questions also assessed for current and prior use of smartphones and mobile phone applications. Participants determined eligible for

participation were contacted by study staff and scheduled for their in-person assessment sessions. The timeline for the methods of the current study are presented in Figure 1.

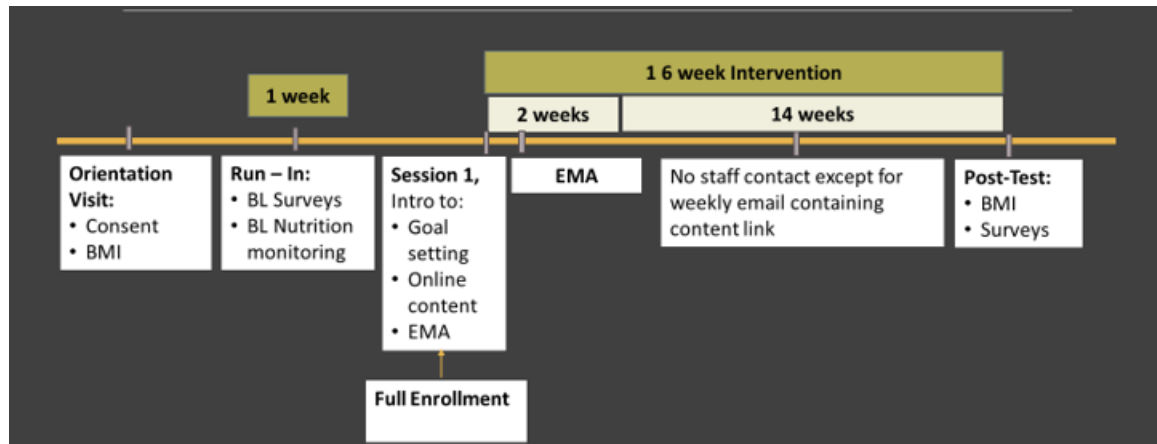


Figure 1: Procedure and intervention timeline.

Orientation Session

The purpose of the present study was to examine home-prepared meal consumption outside of the home as a predictor of weight loss success through ecological momentary assessment. This study was being conducted in conjunction with a larger study to examine experiences of nutrition monitoring to predict outcomes in adherence and weight. Eligible participants were scheduled by study staff to attend a group Orientation Session to complete the consent process and individually record participants' height and weight. The Orientation Session provided participants with mobile application account information, instructions in using the application to monitor nutrition, and practice in completing a nutrition log. In addition, participants were directed to capture nutrition patterns through one-week of baseline nutrition monitoring and were scheduled to return the following week to complete full enrollment by

attending a group Intervention Session for the first week of the weight loss treatment. Full enrollment criteria were met by participants who completed the online baseline assessment, completed 4 out of 7 days of baseline nutrition monitoring, and attendance of the group Intervention Session.

Intervention

This study provided a 16-week weight loss intervention. The content of the first week of the intervention was delivered through an in-person, group-based session provided by study staff. Participants were measured individually during the session and received an introduction to the weight loss treatment and brief instruction on nutrition goal setting. The content for the remaining 15 weeks of treatment was delivered through an online software program, Qualtrics, which was provided through a weekly email containing a link to access the content for that week's session. Weekly sessions consisted of brief (2 – 3 pages) standard cognitive-behavioral content for weight loss skills development and strategies (i.e., physical activity, stimulus control, problem-solving). Participants received automated tailored feedback based on pre-set algorithms for the purpose of reinforcement and change strategies related to their reported weight and dietary goals. Additionally, participants set weekly goals related to nutrition and physical activity, and also set a behavioral goal based on the cognitive-behavioral content.

Measures

Baseline Assessment. Participants were instructed to complete a baseline assessment by completing an online battery of behavioral questionnaires from home that was approximately one-hour in duration.

Demographics. Participants completed a demographic survey assessing age, race/ethnicity, level of education, and socioeconomic status.

Health Consciousness. Participants completed the Health Consciousness Scale (HCS; Schifferstein & Oude Ophuis, 1998), a 7-item, self-report measure used to assess participants' degree of willingness to undertake health-related actions. Participants rated their level of agreement on a scale from 1 (strongly disagree) to 5 (strongly agree) to statements regarding health sacrifice (e.g., I have the impression that I sacrifice a lot for my health) and occupation with health (e.g., I do not continually ask myself whether something is good for me). The HCS demonstrated good internal consistency ($\alpha=.89$). An additional four items were used to assess health consciousness related to eating (Hartmann, Dohle, & Siegrist, 2013). Participants indicated their level of agreement on a 1 (strongly disagree) to 5 (strongly agree) scale to statements such as "My health is dependent on how and what I eat." Higher scores on these measures represent higher levels of health consciousness. These items also demonstrated adequate internal consistency ($\alpha=.83$).

Health Literacy. Participants completed the Newest Vital Sign (NVS; Weiss et al., 2005), a 6-item self-report measure of health literacy. Participants were provided with a nutrition label for an ice-cream container and responded to questions using the

nutritional information. Higher scores on this measure represent higher levels of health literacy. The NVS demonstrated adequate internal consistency ($\alpha=.76$).

Away-From-Home Food Sources. Participants responded to four items regarding away-from-home food sources (Fulkerson et al., 2011). Participants indicated how many times a meal for breakfast, lunch, dinner or snack, respectively, were purchased from a fast-food restaurant, purchased from a full-service sit-down restaurant, delivered, or picked up as takeout. Response options included ‘none,’ ‘1-2 times,’ ‘3-4 times,’ ‘5-6 times,’ and ‘7 times.’ Participants responded to an additional five items related to dietary behaviors outside the home adapted from the Physical and Nutritional Home Environment Inventory (Spurrier, Magarey, Golley, Curnow, & Sawyer, 2008). Participants indicated how often on a scale from 1 (never) to 5 (daily) they “spend a traditional meal outside of the home (i.e., breakfast, lunch, or dinner)” and “prepare meals/snacks ahead of time (e.g., cook, separate, or package).”

Food Preparation. Participants completed the convenience orientation scale (CONVOR; Candel, 2001), a 14-item, self-report measure assessing individual’s food preparation behaviors. Participants rated their level of agreement on a scale from 1 (completely disagree) to 7 (completely agree) to statements regarding saving time (e.g., preferably, I spend as little time as possible on meal preparation) and physical energy (e.g., the less physical energy I need to prepare a meal, the better). The CONVOR demonstrated good internal consistency ($\alpha=.90$). An additional six items were used to assess food preparation and purchasing behaviors (Larson et al., 2006). Participants reported how often on a scale from 1 (never) to 5 (daily) over the past month they engaged in food preparation such as “prepare a green salad” or food purchasing

behaviors such as “bought fresh vegetables.” These items demonstrated adequate internal consistency ($\alpha=.79$).

Ecological Momentary Assessment. Participants responded to an ecological momentary assessment of food preparation and dietary choices during the first two weeks of the intervention. Event-contingent and random-sampling responses (see below) were recorded through the Harvest Your Data mobile phone application on participants’ smartphones.

Event-Contingent Responding. Participants were instructed to complete a brief survey on their smartphone immediately following an eating episode. Participants identified the type of eating episode (Breakfast, Lunch, Dinner, or Snack) and responded to questions about their eating and food preparation experience. Following this prompt, participants were asked the location of where the meal was consumed (i.e., inside the home or outside the home) and if the meal/snack was prepared in the home (by the participant or someone else in the home). Participants were told that home-prepared foods were considered a meal or snack prepared in the home by them or someone else using raw, unprocessed fresh or frozen foods, including meat, fish, eggs, fruits and vegetables, and minimally processed ingredient foods such as flour, sugar, spices, condiments, butter or margarine, pasta, and whole grains, as well as canned vegetables containing no additional seasoning or sauce. They were instructed that meals comprised of premade microwaveable, boxed or frozen meals and side dishes that require limited time, energy and skill to prepare were not considered home-prepared regardless of being organized, heated or cooked in the home, or added to raw, unprocessed foods previous mentioned.

Motivations for Eating Home-Prepared Food. Participants who consumed home-prepared food for the most recent eating episode indicated their motivations for eating home-prepared food (Bisogni, Jastran, Seligson, & Thompson, 2012; Monsivais et al., 2014). Participants were asked to select all that apply from the following motivations: a) Save money, b) Save time, c) Eat healthier, d) Lose weight, and e) Other.

Source of Away-From-Home Food. Participants who did not consume home-prepared food for the most recent eating episode indicated the source of the food they ate (Fulkerson et al., 2011). Response options included: a) Fast-food, b) Convenience store, c) Sit-down restaurant, d) Take-out, e) Delivery, f) Ready-made from grocery store, and g) Other.

Barriers to Preparing Home-Prepared Food. Participants who did not consume home-prepared food for their most recent eating episode indicated the barriers that prevented them from preparing home-prepared food for that particular meal or snack (Bisogni et al., 2012; Jabs et al., 2007; Reicks, Trofholz, Stang, & Laska, 2014). Participants who ate meals were asked to select all that apply from the following barriers: a) Did not intend to prepare a meal or snack, b) No food in the house, c) Not enough time to prepare food, d) Not enough confidence in cooking abilities, e) Not enough knowledge of recipes, and f) Other.

Barriers to Eating Home-Prepared Food. Participants who did not consume home-prepared food for their most recent eating episode indicated the barriers that prevented them from eating home-prepared food for that particular meal or snack (Asp, 1999; Cruwys et al., 2015; Elliston et al., 2016; Jabs et al., 2007). Participants who ate

meals inside the home were asked to select all that apply from the following barriers: a) Did not intend to eat home-prepared food, b) No foods prepared ahead of time, c) Not enough time to prepare food, d) Social interaction (i.e., ordered with others, others brought food), e) Craving other food, and f) Other. Participants who ate meals outside the home were asked to select all that apply from the following barriers: a) Did not intend to eat home-prepared food, b) I forgot it at home, c) No place to store/heat food (e.g., fridge, microwave), d) Social interaction (i.e., went out with others, ordered with others), e) Craving other food, f) Not a cultural norm (e.g., others don't bring home-prepared food, others question behavior, frowned upon, etc.), g) No means of storing or transporting food (e.g., no containers, lunch box), and h) Other.

Adherence to Nutrition Goals. Participants indicated their level of agreement with several statements rated on a 1 (strongly disagree) to 5 (strongly agree) scale based on their most recent eating episode. Participants were asked, “Based on the nutrition information you recorded, rate your level of agreement with the following statements” a) My most recent eating episode is consistent with my nutrition goals, b) I feel successful with my diet, and c) I can maintain my diet. Adherence to nutrition goals was adapted from Dohle and colleagues’ (2015) prior research on ingredient awareness during food preparation.

Random-Sampling Responding. Participants were prompted two times per day via text message to complete a brief EMA survey on their smartphone. Participants were asked to indicate if they missed monitoring an eating episode since the last time they received a random-sampling prompt. If so, participants indicated which meal(s) they had skipped (Breakfast, Lunch, Dinner, or Snack), and were asked to respond to

questions based on the most proximal missed monitoring of an eating episode only. Participants reported the location of where the food was consumed, if the food was prepared in the home, and responded to the Motivations for Eating Home-Prepared Food, Source of Away-From-Home Food, Barriers to Preparing Home-Prepared Food, Barriers to Eating Home-Prepared Food, and Adherence to Nutrition Goals questions listed above. Participants who had not missed monitoring an eating event since the last random-sampling completing survey questions examined by the associated larger study, and thus were not entered into the proposed analyses.

RESULTS

Overall, forty-seven participants completed the EMA portion of the study. Two participants did not complete measures pertaining to eating episodes through either event-contingent or random-prompt responding, and thus were excluded from analyses. Additionally, 17 out of 47 (36%) participants that completed the EMA portion of the study completed the post-test assessment. Table 1 presents participant demographics by variables of interest. There were no differences by attrition in sex $\chi^2(1) = .081$, $p = .776$, ethnicity $\chi^2(5) = 2.631$, $p = .757$, age $\chi^2(29) = 36.172$, $p = .169$, household income $\chi^2(6) = 3.153$, $p = .789$, education $\chi^2(3) = .951$, $p = .813$, BMI $F(1, 47) = 1.589$, $p = .214$, health literacy $F(1, 45) = .093$, $p = .762$, health consciousness $F(1, 45) = 2.850$, $p = .098$, and meals prepared in the home $F(1, 43) = .187$, $p = .667$ between EMA completers and post-testing participants. Analyses were completed using data from all participants completing EMA entries. In addition, intent to treat analyses were conducted post-hoc for participants who did not complete the post-test assessment in which their baseline weight was carried forward. Further, the intervention employed in the current investigation allowed for additional post-hoc analysis of weight loss outcomes; participants in this study provided self-report weight during each weekly module of the online intervention. Percent weight change was examined using baseline weight recorded by study staff during orientation for the weight loss intervention and participants' last reported weight provided in the intervention.

All analyses examining frequency of meal consumption (i.e., home-prepared, meals outside the home, motivations, or barriers) have been aggregated and converted to a proportion relative to all meals monitored. For example, the frequency of home-

prepared meal consumption is defined as the frequency of home-prepared meals relative to the frequency of total meals monitored. The frequency and location of meals consumed are presented in Table 2.

Table 1. Participant Demographics by Variables of Interest					
Demographic	Meals prepared in the home <i>M (SD)</i>	Meals consumed outside the home <i>M (SD)</i>	Health Literacy <i>M (SD)</i>	Health Consciousness <i>M (SD)</i>	Percent Weight Change <i>M (SD)</i>
Sex					
Men	69.32 (16.06)	42.82 (30.51)	5.40 (.51)	4.13 (.53)	-2.16 (2.92)
Women	60.47 (18.28)	49.11 (17.95)	5.05 (1.26)	3.94 (.45)	-1.62 (5.32)
Race (Ethnicity)					
Caucasian	63.89 (16.22)	41.52 (18.84)	5.29 (1.13)	3.96 (.48)	-2.63 (4.56)
African American	55.79 (15.60)	57.49 (21.82)	4.69 (1.18)	3.99 (.47)	.05 (1.87)
Hispanic	34.42 (26.04)	55.92 (28.39)	5.50 (.70)	4.37 (.35)	5.43 (-)
Other	78.46 (15.71)	52.97 (22.33)	5.20 (1.30)	3.95 (.43)	- (-)
Education					
Completed high school/some college	63.50 (28.97)	42.74 (30.06)	4.85 (1.67)	3.92 (.47)	-3.40(1.74)
Completed 2-4 year college	55.22 (17.02)	52.33 (22.49)	5.10 (1.24)	4.03 (.56)	-1.30 (5.30)
Graduate or professional degree	67.08 (12.93)	45.32 (15.92)	5.23 (.88)	3.96 (.38)	-1.78 (5.16)
Household Income					
\$0 – 30,000	61.96 (17.93)	45.95 (20.39)	4.44 (1.42)	4.23 (.37)	-6.77 (6.51)
\$30,000 - 60,000	56.92 (22.49)	55.41 (20.33)	5.20 (1.20)	3.89 (.43)	-1.29 (6.18)
\$60,000 - 90,000	65.33 (16.17)	45.32 (19.50)	5.33 (.50)	3.80 (.50)	-.63 (3.60)
\$90,000+	65.35 (14.47)	42.33 (22.82)	5.35 (1.15)	4.05 (.50)	-1.09 (3.14)

Note: Meal means represent percent of total meal consumption.

Hypothesis One: Weight Loss and Home-Prepared Food Consumption

Participants who completed the intervention achieved an average weight loss of 1.7% of their total body weight ($M = 4.07\text{lbs.}$, $SD = 10.34\text{lbs.}$). Intent to treat analyses

demonstrated an average weight loss of .4% of total body weight ($M = .85\text{lbs.}$, $SD = 6.38\text{lbs.}$). Analysis of participants' self-report weight indicated an average weight loss of 2.1% of their total body weight ($M = 5.04\text{lbs.}$, $SD = 6.93\text{lbs.}$). A Pearson correlation was used to determine if more frequent consumption of home-prepared meals was associated with greater weight loss following the intervention. Although trending in the predicted direction, home-prepared meal consumption was not associated with weight loss $r(16) = -.455$, $p = .077$. Post-hoc analyses revealed there was no association using intent to treat weight loss and home-prepared food consumption $r(47) = -.278$, $p = .065$. Self-report weight demonstrated a similar relationship with home-prepared food consumption, $r = -.270$, $p = .084$. Additionally, a repeated measures analysis of variance (RANOVA) was used to determine if there were differences among percent weight change using the three aforementioned approaches. Overall, there was no difference among percent weight change $F(1.00, 16.04) = 2.849$, $p = .111$.

Table 2. *Frequencies of Food Source and Location of Meals Consumed*

	Meals prepared inside the home N (%)	Meals from other sources N (%)	Meals consumed inside the home N (%)	Meals consumed outside the home N (%)
Total meals	895 (63.9)	504 (36.0)	765 (54.7)	634 (45.3)
Meals consumed outside the home	240 (37.9)	394 (62.1)	-	-
Meals consumed inside the home	655 (85.6)	110 (14.4)	-	-

Note: Participants did not intend to prepare home-made food during 360 (71%) eating episodes and did not intend to eat home-made food during 264 (52%) eating episodes in which meals came from other sources.

Hypothesis Two: Perceptions Related to Home-Prepared Food Consumption

A paired-samples t-test was used to determine if more frequent consumption of home-prepared food, relative to food from other sources, was associated with perceptions of eating consistently with nutrition goals. The frequency of meal

consumption and perceptions of meeting nutrition goals was assessed through EMA while meal consumption was dichotomized as home-prepared meals and non-home-prepared meals (i.e., away-from-home food sources). Analyses revealed that individuals perceived eating more consistently with nutritional goals when consuming food prepared in the home ($M = 3.77$) compared to food from other sources ($M = 3.01$), $t(46) = 5.73, p < .001$.

In addition, post-hoc analyses used hierarchical linear modeling (HLM) to examine momentary differences of perceived goal consistency as predicted by home-prepared foods. Hierarchical linear modeling allows for within-person and between-person analyses to be conducted simultaneously while adjusting for the autocorrelation of observations that would otherwise produce biased results (Hox, 2002). Within-subjects variables were person-centered (i.e., individual raw scores were subtracted from his or her individual mean) allowing for examination of deviations from each individual's mean, and between-subjects variables were grand-centered (i.e., individual mean scores were subtracted from the group mean score) enabling examination of individuals relative to the participants as a group. Both within and between-subjects perceived goal consistency were associated with more frequent home-prepared food consumption. Specifically, higher levels of home-prepared food consumption was associated with greater perceptions of meeting nutrition goals $t(45) = -2.22, \beta = -.922, p = .031$. In addition, episodes in which a home-prepared meal was consumed, relative to away-from-home meals, predicted higher levels of perceived consistency with meeting nutrition goals, $t(1351) = -7.80, \beta = -.863, p < .001$. Post-hoc analyses also examined perceptions of maintaining one's diet and feeling successful with one's diet as predicted

by consumption of home-prepared food. Between-subjects analyses indicated that higher levels of home-prepared meal consumption were not associated with perceptions of diet maintenance, $t(45) = -.478$, $\beta = -.268$, $p = .635$, nor diet success, $t(45) = -.518$, $\beta = -.269$, $p = .607$. Within-subjects effects, however, revealed that eating episodes in which participants ate home-prepared meals relative to food from other sources, demonstrated greater perceptions of being able to maintain one's diet $t(1351) = -3.91$, $\beta = -.135$, $p < .001$ and success with one's diet $t(1351) = -5.12$, $\beta = -.328$, $p < .001$.

Hypothesis Three: Weight Loss and Meals Outside the Home

A Pearson correlation was used to determine if greater frequency of meals consumed outside the home (i.e., work, traveling, social gathering, etc.) was associated with less weight lost following the 16-week self-administered weight loss intervention. The frequency of meals outside the home was collected through EMA and compared to percent weight loss at post-assessment. The frequency of meals consumed outside the home was not associated with weight loss, $r(17) = .320$, $p = .210$. Post-hoc analyses revealed there was no association using intent to treat analysis, $r(47) = .133$, $p = .374$ or self-reported weight change, $r(47) = .015$, $p = .920$.

Hypothesis Four: Health Consciousness and Home-Prepared Meal Consumption

A Pearson correlation was used to determine if participants higher in health consciousness consumed more home-prepared meals than participants lower in health consciousness. Health consciousness was assessed at baseline. Levels of health consciousness were not associated with consumption of home-prepared meals, $r(45) = .153$, $p = .314$.

Hypothesis Five: Motivations to Consuming Home-Prepared Food

A repeated measures analysis of variance (RANOVA) was used to determine if individuals consuming home-prepared food reported greater motivations to lose weight compared to other motivations (i.e., save time, save money, or eat healthier). Barriers to preparing home-made food were collected through EMA and aggregated across all time points. Overall, there were significant differences among the motivations $F(2.29, 105.61) = 7.884, p < .001, \eta_p^2 = .146$. As shown in Table 3, post-hoc pairwise comparisons using the Bonferroni test revealed that saving money and eating healthier were greater motivations to prepare and consume home-made food than losing weight or saving time.

Table 3. <i>Difference in Motivations to Prepare Home-Made Food</i>		
Motivation	Mean	Standard Deviation
Save money	.645 ^A	.370
Save time	.409 ^B	.366
Eat healthier	.607 ^A	.326
Lose weight	.445 ^B	.367

Note: Means sharing a letter in their superscript are not significantly different at the .05 level.

Hypothesis Six: Barriers to Consuming Home-Prepared Food

Nonparametric testing was required to examine whether time constraints were associated with less frequent consumption of home-prepared food relative to other barriers; barriers to preparing and consuming home-prepared food were not evenly distributed and violated assumptions of parametric statistical analyses. Barriers to preparing home-made food were collected through EMA and aggregated across all time points. Given the limited variety and number of endorsements of limited cooking ability ($n = 15$) and knowledge of recipes ($n = 14$), forgetting food ($n = 13$), not a cultural norm ($n = 15$), and lack of storage ($n = 26$) or transportation ($n = 26$), these barriers were

excluded from analyses to increase reliability of findings. A frequency cutoff of 40 endorsements was used to examine the most prevalent barriers of time ($n = 107$), social interaction ($n = 121$), craving other foods ($n = 72$), and no food available in the home ($n = 45$) in order to allow for greater power while still meeting statistical assumptions.

Analyses using Friedman's ANOVA showed there were significant differences among the barriers to preparing and consuming home-prepared meals $\chi^2(3) = 23.815$, $p < .0001$. Post-hoc analysis using Wilcoxon signed-rank tests was conducted with a Bonferroni correction applied, resulting in a significance level set at $p < .008$. Analyses revealed that time ($M = .193$, $Mdn = .111$, $SD = .220$) was a more significant barrier to preparing and consuming home-made food than not having food in the house ($M = .104$, $Mdn = .000$, $SD = .241$), $Z = -2.813$, $p = .005$. In addition, social interactions ($M = .240$, $Mdn = .166$, $SD = .261$) were a greater barrier than not having food available as well, $Z = -3.010$, $p = .003$. No other comparisons were significant using the Bonferroni correction; however, social interactions appeared to be a greater barrier than craving other foods ($M = .132$, $Mdn = .000$, $SD = .197$) at the traditional significance level (i.e., $p < .05$).

Hypothesis Seven: Cooking Ability and Knowledge and Health Consciousness

Although confidence in cooking ability ($n = 15$) and knowledge of recipes ($n = 14$) were hypothesized to correlate with higher levels of health consciousness, analyses were unable to be conducted due to the lack of variety and relative number of responses among participants.

Hypothesis Eight: Health Literacy and Home-Prepared Meal Consumption

A Pearson correlation was used to determine if health literacy was significantly associated with consumption of home-prepared meals. Health literacy was assessed at baseline. Analyses revealed there was no association between health literacy and consumption of home-prepared meals $r(45) = .124, p = .417$.

Hypothesis Nine: Health Literacy and Weight Loss

A Pearson correlation was also used to determine if higher levels of health literacy were associated with significantly greater weight loss following the intervention. Health literacy was not associated with weight loss following the intervention, $r(17) = .271, p = .293$. A similar relationship was found using intent to treat analysis, $r(47) = .165, p = .268$. Self-reported weight change, however, was associated with health literacy, $r(47) = .347, p = .017$.

Post-Hoc Analyses

Relationship Between Home-Prepared Food Consumption Outside the Home and Health Consciousness, Health Literacy, and Weight Loss. Given the literature highlighting negative outcomes associated with meals consumed outside the home, the relationship between home-prepared food consumption outside the home and health consciousness, health literacy, and weight loss was also examined. However, Pearson correlations revealed home-prepared food consumption outside the home was not associated with health consciousness [$r(46) = -.082, p = .587$], health literacy [$r(46) = .086, p = .569$], or weight loss [$r(17) = -.043, p = .869$]. Intent to treat analyses revealed no association between weight loss and home-prepared meal

consumption outside the home as well, $r(46) = -.066$, $p = .665$. Self-reported weight change demonstrated a similar relationship, $r(46) = -.043$, $p = .777$.

Comparison of Self-Report Food Preparation and EMA Food Preparation.

To examine for consistency between self-report and EMA reporting, post-hoc analyses examined the relationship between self-report measures of food preparation behaviors collected at baseline and equivalent EMA constructs. There was a significant association between self-report and EMA home-prepared meals consumed outside the home [$r(47) = .301$, $p = .042$]. Self-reported food preparation, however, was not associated with home-prepared food assessed through EMA $r(45) = .270$, $p = .073$.

Relationship Between Food Preparation Behaviors and Home-Prepared Food Consumption, Health Literacy, Health Consciousness, and Weight Loss.

Food preparation behaviors measured at baseline were explored due to insufficient EMA endorsements of recipe knowledge and cooking ability. Thus, post-hoc analyses examined the relationship between the convenience orientation scale (CONVOR), a self-report measure assessing an individual's propensity to save time and energy during food preparation, with frequency of home-prepared food, health consciousness, health literacy, and weight loss. The CONVOR was inversely related with the frequency of home-prepared food consumption [$r(45) = -.395$, $p = .007$] indicating that individuals unwilling to invest time and energy in food preparation are less likely to consume home-prepared food. The CONVOR was not associated with health consciousness [$r(47) = -.100$, $p = .505$], health literacy [$r(47) = .046$, $p = .761$], percent weight change [$r(17) = .405$, $p = .107$], or self-report weight change [$r(47) = .226$, $p = .127$]. Intent to treat

analyses, however, revealed a positive association between the CONVOR and weight gain $r(47) = .295, p = .044$.

DISCUSSION

The current study was designed to examine the impact of home-prepared food consumption, including personal characteristics associated with food preparation behaviors, on weight loss outcomes following a 16-week self-help weight loss intervention. While there is an abundance of literature supporting the association between home-prepared food and positive health outcomes (Larson et al., 2006; Monsivais et al., 2014), only one study to our knowledge has captured food choice behaviors in the moment (Elliston et al., 2016). This investigation utilized EMA to capture momentary experiences in an individual's food environment.

Home-Prepared Food Consumption and Weight Loss. Consumption of home-prepared food has been shown to increase healthful eating, decrease consumption of energy dense foods from other sources, and has been linked to overall health and survival (Larson et al., 2006; Smith et al., 2013). In this investigation, home-prepared food consumption and weight loss failed to meet conventional standards of statistical significance. Nevertheless, there was a moderate effect size ($r = -.455$, $p = .077$) for this relationship in the predicted direction. These findings appear to be consistent with previous research highlighting the association between food preparation and BMI (Kolodinsky & Goldstein, 2011). Consumption of home-prepared foods have been linked with an increased likelihood of meeting dietary objectives for fat, calcium, fruits, vegetables, and whole grains compared to foods from other sources (Monsivais et al., 2014). Home preparation may enable individuals to consume a more balanced and healthful diet. Further, consumption of home-prepared food has the potential to increase the likelihood of avoiding a caloric surplus that would otherwise prevent

successful weight loss or weight maintenance through the impact of ingredient selection. More frequent food preparation has also been shown to decrease visits to fast-food restaurants (Larson et al., 2006). Home food preparation likely allows one to limit other source foods in one's diet, particularly fast-food, and reduce the consumption of energy dense meals, fat and saturated fat and cholesterol which are known contributor to weight gain and additional health concerns (Guthrie et al., 2002).

Although the relationship between home-prepared foods and weight loss did not meet statistical significance in the current study, preparation of foods in the home may go beyond the deleterious effects of fast-food and include other food sources of uncertain quality. Grocery store convenience and ready-made meals, although advertised as healthy (i.e., low-fat, natural), often contain ingredients high in sugar, fat, or sodium that may not be readily noticed by the consumer. Increased consumption of home-prepared foods has the potential to overcome misleading marketing that may contribute to caloric surplus and weight gain associated with such foods. While these foods may not be harmful in the short-term, regular intake may lead to excessive calorie consumption and weight gain. What's more, high amounts of sugar and fat may greatly increase the food's palatability, leading to greater consumption of these foods.

Research suggests that consumption of these ingredients can cause endogenous opiates to be released which stimulate the brain's reward center (Drewnowski, Krahn, Demitrack, Nairn, & Gosnell, 1992). This mechanism may prompt future consumption of fat and sugar abundant foods that provide similar feelings of rewards. Food preparation may interrupt this cycle and ensuing weight gain trajectory by limiting the frequency and volume of other source foods in one's diet. Generally speaking, home-

prepared food consumption has the potential to be a successful predictor of weight loss following an internet-based self-help weight loss intervention.

Post-hoc analyses using intent to treat analysis (baseline forward) and participant self-reported weight demonstrated similar percent body weight loss associated with consumption of home-prepared food. These findings, however, are conservative estimates of weight loss. For example, individuals who failed to complete the full intervention are likely to have experienced minimal weight loss and possible weight gain. Limited weight loss from such a large subset of the sample likely hinders the potential for meeting conventional standards of statistical significance. Further, care should be taken when interpreting these results as self-reported weight may not be valid or reliable. It is unknown whether participants wore similar clothing, used the same scale, or weighed themselves at a consistent period of the day.

A number of factors may account for why the association between percent weight loss and home-prepared food consumption failed to meet conventional standards of statistical significance. First and foremost, the high attrition of the weight loss treatment greatly reduced the power to detect associations between EMA responding and weight loss outcomes. The rate of attrition in the current study was 63%. While attrition rates from comparable studies are difficult to find as most internet-based self-administered weight loss interventions maintain various forms of interaction with study staff (e.g., email feedback and online blogs), other minimal contact treatments have reported attrition of 41% and 45% (Allen, Stephens, Dennison Himmelfarb, Stewart, & Hauck, 2013; Carter, Burley, Nykjaer, & Cade, 2013). In fact, increased study contact and additional peer support have been proposed to improve

program engagement in internet-based interventions (Hutchesson, Tin, Morgan, Callister, & Collins, 2016; Saperstein, Atkinson, & Gold, 2007).

While we were disappointed to see that only 36% of participants completing the EMA portion of the study returned for the post-assessment and weigh-in, prior research has suggested that internet-based, self-administered interventions are at high risk for attrition and poor adherence (Eysenbach, 2005). Additionally, these interventions are also noted to produce more modest weight loss outcomes compared to standard in-person behavioral weight loss treatments (Wieland et al., 2012). In this investigation, participants completing the intervention achieved percent body weight loss of 1.7% of total body weight ($M = 4.07\text{lbs.}$, $SD = 10.34\text{lbs.}$). The current study provided minimal contact with study staff following the introductory face-to-face orientation, likely decreasing participant engagement in the intervention. It is possible that decreased engagement and nonadherence to weight loss treatment limited weight loss success. Consistent with prior research, excessive attrition greatly limited the ability to identify correlates and predictors of outcomes following treatment (Fabricatore et al., 2009).

Perceptions Related to Home-Prepared Food Consumption. Perceptions surrounding home-prepared food consumption were also examined. Relative to food from other sources, increased consumption of home-prepared foods was associated with participants' perceptions of eating consistently with nutrition goals. Although slightly less robust, between-subjects effects were similar to within-subjects effects. Exploratory analyses also revealed within-subjects effects for greater perceptions of being able to maintain one's diet and being successful with one's diet when consuming home-prepared foods (between-subjects analyses were not significant). These findings

suggest individuals felt more successful and capable of maintaining their diet during episodes when eating home-prepared meals relative to food from other sources (e.g., fast-food, convenience meals, etc.). Surprisingly, overall, between subjects analyses revealed that more frequent consumption of home-prepared food did not predict perceptions of success and maintenance with one's diet.

Interestingly, while eating a home prepared meal had positive momentary perceptions on weight loss, people who ate more home-prepared meals did not have more positive weight loss perceptions. Perceptions related to consuming home-prepared food, perhaps, may be influenced by additional factors not examined in the current investigation. For example, failure to meet weight loss goals may interfere with one's perceived success with their diet whereas ability to maintain one's diet may be hindered due to limited time to prepare homemade food during previous eating episodes. Alternatively, perceptions related to eating a home prepared meal do not appear to transcend beyond the meal consumed, more generally, to reflect larger overall patterns.

Earlier research has demonstrated that food preparation increases the salience of the food and awareness of ingredients used which may influence perceptions of healthful eating (Dohle et al., 2015). Individuals preparing food in the home are likely to perceive meeting nutrition goals as they are aware of what comprises their meals. This process may enable individuals to assess whether a food is healthy, which could lead to increased perceptions of eating consistent with nutrition goals. A study conducted by Dohle et al. (2015) presented two randomized groups with recipes for milkshakes they would later prepare; participants preparing the healthy milkshake (i.e., low-calorie

raspberry shake) reported increased liking of the food compared to the unhealthy milkshake (i.e., high-calorie chocolate shake) condition. Although ratings of taste were not examined, participants perceived the healthy shake as healthier and lower in calories, and consumed more than participants in the unhealthy shake condition. These findings suggest preparation of food may promote awareness of ingredients comprising one's food, and appraisals of healthy eating that foster liking and increased consumption of healthful food. Taken together, perceptions of goal consistency with one's diet related to home-food preparation may promote behaviors associated with successful weight maintenance.

Further, exploratory analyses revealed that willingness to invest time and energy in food preparation indicated a marginal effect (using intent to treat analysis) on weight loss, supporting the association between perceptions of home-food preparation and successful weight loss outcomes. In fact, willingness to invest time and energy preparing food was significantly related to perceptions of success with one's diet [$r = -.296, p < .05$] and trended in a similar direction for consistency with nutrition goals [$r = -.266, p = .074$]; there was no association with diet maintenance [$r = -.194, p = .196$]. Perhaps individuals who exert more time and energy in food preparation consider their efforts more favorable for achieving weight loss goals. Alternatively, it is also possible that people who are successful at losing weight may be energized to invest time and energy into food preparation. Nevertheless, it would appear that awareness of ingredients and investing effort in food preparation may be factors associated with increased consumption of home-prepared food and weight loss outcomes.

Generally speaking, perceptions of success, maintenance, and consistency with one's weight loss goals may have implications for outcomes in weight loss interventions as well. Perceived self-efficacy refers to the belief in the ability to perform and succeed in challenging situations (Bandura, 1977). With regard to weight loss, perceptions related to success and maintenance with one's diet may correspond to beliefs regarding engagement in weight loss behaviors and weight loss outcomes. In fact, self-efficacy related to eating behaviors has been shown as a predictor of treatment adherence and weight loss (Linde, Rothman, Baldwin, & Jeffery, 2006). More specifically, higher perceptions of confidence in eating behaviors was associated with greater weight loss following an 8-week weight loss intervention.

It remains to be seen whether perceptions related to success, maintenance, and consistency with dietary goals associated with home-prepared food consumption were present at baseline or engagement in the intervention increased these perceptions. For example, individuals may possess beliefs related to their ability to achieve weight loss outcomes that enhance their engagement in positive eating behaviors. In contrast, it is also possible that engagement in healthy dietary behaviors leads to increased self-efficacy related to weight loss. Nevertheless, perceptions of success and ability to maintain one's diet may lead to increased treatment adherence that promote successful weight loss outcomes. It will be important for future research to determine if changes in cognitions associated with food preparation contribute to greater adherence and success in weight loss interventions.

Weight Loss and Meals Outside the Home. Previous research has highlighted the link between foods consumed outside the home (regardless of source) and an

increased likelihood of being overweight or obese and failing to meet dietary guidelines for consumption of daily energy, total fat, and saturated fat (Bowman & Vinyard, 2004; Fulkerson et al., 2011). In the current study, increased frequency of meals consumed outside the home was not associated with weight loss following the 16-week self-administered weight loss intervention. It is important to note, however, that the EMA period only examined the first two weeks of the weight loss intervention. This monitoring period may have been too short to capture unbiased participant behaviors. For example, individuals entering a weight loss program may be initially motivated to refrain from eating outside the home. Subsequent assessments may reveal changes in the frequency of meals consumed outside the home and weight gain. Further, measures assessing the source of foods being consumed may have led to demand characteristics among participants. More specifically, inquiring about the consumption of “good” (i.e., home-prepared) and “bad” (i.e., fast-food) foods could have led participants to change their eating behaviors in accordance with study hypotheses. Thus, natural eating behaviors may not have been captured during this assessment period.

Research has posited that more people are spending traditional meal times away from home due to work and other obligations (Devine et al., 2009), which accompanied with the prevalence of unhealthy convenience foods, would suggest an increased likelihood of losing less weight when eating outside the home. In fact, Kruger and colleagues (2006) found a decreased likelihood of successfully losing weight when eating outside the home compared to individuals who did not experience such barriers. This was not the case in the current study. Perhaps awareness of measures assessing

food consumption outside the home may have led participants to alter their behaviors. Self-monitoring is considered a reactive data-gathering technique as it can affect the frequency of behaviors being assessed (McFall, 1970). A study examining college undergraduate smoking rates using self-monitoring found that students monitoring smoking occurrences increased their frequency of smoking whereas students monitoring occasions of not smoking decreased their frequency of smoking. In fact, self-monitoring has been suggested as a brief stand-alone method of behavior modification (Gottman & McFall, 1972). Responding to several event-contingent and random prompts may have increased participants' awareness of dietary behaviors similar to self-monitoring, which combined with the weight loss intervention, likely influenced the frequency of behaviors being monitored.

In addition, although EMA avoids retrospective recall, this methodology relies upon self-monitoring of dietary behaviors. Above and beyond the problems caused by attrition, full compliance of participant behaviors, was not observed. Participants in the current study only completed approximately 70% of the signaled random prompt responses. Event-contingent response compliance, however, is difficult to assess because target events (i.e., meals and snacks) are often unpredictable as within and between-subject food consumption varies. In accordance with the larger study conducted in conjunction with this investigation, it was determined that participants recorded 2.88 eating events per day during the 14-day assessment period and, on average, 1.69 event-contingent responses per day, which equates to a compliance rate of 58% for event-contingent responding. Full compliance was likely hindered due to burden, as participants were asked to engage in weight loss behaviors and complete

event-contingent and random prompt responding. Dietary behaviors occurring during these missed responses may have provided important information related to meals consumed outside the home. Nonadherence to EMA responses may be due to reluctance to report perceived unhealthy meals. Similar to demand characteristics discussed earlier, it is possible that participants withheld responses related to meals consumed outside the home or foods from other sources (i.e., convenience or fast-food). Likewise, participation in a weight loss program is likely to serve as a deterrent to reporting foods and/or situations that are not consistent with treatment recommendations and weight loss goals.

Health Consciousness and Health Literacy. Because of the dearth of research associated with home-prepared food consumption, it has been difficult to assess the characteristics associated with food preparation behaviors. Research on health consciousness has shown the potential for individuals to overcome barriers associated with dietary behaviors in order to achieve a desired weight. In a study examining consumer food choice, individuals higher in health consciousness were less likely to be overweight, had greater knowledge of nutrition, and were more likely to make healthier food choices (Schifferstein & Oude Ophuis, 1998). Likewise, increased levels of health literacy may enable individuals to have an effective impact on their health care environment (Berkman et al., 2011). For example, limited health literacy may prevent individuals from reading and interpreting food labels and adhering to medication or other prescribed regimens. Prior research examining health literacy outcomes in a stepped-care weight loss intervention found that individuals higher in

health literacy were more likely to lose a clinically significant amount of weight, and were less likely to be stepped up (Carels et al., 2017).

Although health literacy was associated with participant self-reported weight, the relationship between health literacy and weight change recorded by study staff and intent to treat analyses fell short of statistical significance. In addition, as noted earlier, self-reported weight may not be valid or reliable due to a number of factors which highlights the need to exercise caution while interpreting this significant finding. Therefore, overall, health consciousness and health literacy were not significant predictors of home-prepared food consumption nor weight loss following the intervention.

Upon further examination, it seems that health literacy and health consciousness may have had limited variability, perhaps, influencing the ability to determine its effectiveness as a predictor of weight loss. Scale development of the Newest Vital Sign (NVS) reported a much higher variance ($SD = 1.90$; Weiss et al., 2005) compared to the current investigation ($SD = 1.15$). The high socioeconomic status of the study sample may have affected the variance of health consciousness and health literacy; forty-five percent of participants completed graduate or professional school while 49% reported an annual household income greater than \$60,000. In fact, limited levels of health literacy are associated with low socioeconomic status such that health literacy increases with years completed in school and income above the poverty threshold (Adams et al., 2013; Kutner, Greenberg, Jin, & Paulsen, 2006). In the current study, household income was trending in a similar direction ($r = .26, p = .076$), though education was not related to health literacy ($r = .18, p = .22$). Health consciousness, however, has not

been linked to socioeconomic status (Iversen & Kraft, 2006; Wardle & Steptoe, 2003), although individuals enrolled in a weight loss program may be likely to display higher levels of health consciousness as they recognized a need to alter their weight status for improving their overall health.

Motivations to Consume and Prepare Food in the Home. It was also hypothesized that individuals would report greater motivations to lose weight when consuming home-prepared food compared to other motivations. In contrast to this hypothesized relationship, saving money and eating healthier were greater motivations to preparing and consuming home-made food than losing weight and saving time. Saving money and keeping costs down have been cited as a food management skill that enable individuals to influence their food environment and make informed food choices (Bisogni et al., 2005). Managing food costs is a technique associated with preparing meals and minimizing consumption of food from other sources. Individuals monitoring their costs of food are more likely to cook from scratch and stretch out ingredients, as well as pack a lunch for work and avoid eating out. Although the average reported annual household income of the current sample was higher than expected, it seems that the cost of food is a critical component of preparing meals at home.

Interestingly, individuals felt they were eating consistent with their nutrition goals when consuming home-prepared foods, though it appears losing weight was not the reason for engaging in this behavior. Losing weight may have been an added benefit, but not a motivator to avoid eating food from other sources. It is also possible that individuals considered eating healthier as a method of losing weight. A review of

qualitative research examining eating behaviors revealed associations between weight management and interpretations of healthy eating (Bisogni, Jastran, Seligson, & Thompson, 2012). Individuals often used dichotomous categorization of “good food” or “bad food” in defining healthful eating as it related to the physical consequences of health. Research of food evaluation has shown that foods perceived as healthy are indicated by their capacity to affect weight (Carels, Konrad, & Harper, 2007). Healthy foods that are likely to lead to weight loss are considered high in nutrients and low fat, whereas unhealthy foods that are likely to lead to weight gain are considered high calorie, high fat, and high in sugar. Given this association, black and white thinking about healthful eating is likely to be related to the potential for weight gain and weight loss. Thus, motivations to eat healthier may have included goals of weight management. In fact, motivations to eat healthier were highly correlated with motivations to lose weight ($r = .80, p < .0001$) suggesting these factors are not orthogonal.

Barriers to Consuming and Preparing Home-Made Food. Barriers to preparing and consuming home-made food were also examined. Time and social interactions were found to be the greatest barriers to preparing and consuming home-prepared food. These findings are consistent with prior research examining barriers related to weight outcomes and dietary behaviors (Bisogni et al., 2005; Monsivais et al., 2014). Food preparation is a time-consuming task that requires preparing, cooking, and cleaning. Thus, it should come as no surprise that time scarcity has been cited as the most common barrier to preparing and consuming home-made food (Jabs et al., 2007). Fast-food and other convenience foods are often relied upon for meals when

experiencing time limitations (Jabs & Devine, 2006). Economic conditions often make it difficult to set aside time to prepare home-made food as many people face schedule constraints due to working multiple jobs and inflexible hours. In fact, people today spend more time away from home during traditional meal times due to work and other obligations (Devine et al., 2009). Although food preparation requires time and effort, consuming other source foods rather than healthier options such as home-cooked meals is likely to have long-term consequences.

Social influence has been shown to be a primary predictor of eating behavior (Cruwys et al., 2015). Results from the current study support this relationship, indicating social interactions are a potential barrier to preparing or consuming home-made food. In fact, prior research using EMA demonstrated a higher probability of eating if food is available and others are observed eating (Elliston et al., 2016). Individuals in Elliston and colleague's study were more likely to consume higher density snacks when presented with external cues (i.e., available food and others eating), which suggests social interactions and the dietary behaviors of others likely interfere with goals associated with healthful eating and weight loss outcomes. Unfortunately, social interactions have been shown to have a large influence on food choice, and are far from stable (Bisogni et al., 2005); changes in social support, financial support, and personal responsibilities contribute to both positive and negative alterations on relationships with food and eating. Thus, fluctuations in the effects of social relationships on dietary behaviors are not universally positive or negative and may facilitate or hinder weight loss goals depending on their function.

Although social interactions appear to interfere with attainment of weight loss goals, behavioral weight loss interventions are a suitable mechanism to provide education and skill development to buffer these effects. Developing drink refusal skills has shown positive outcomes in the treatment of alcohol use disorder when social pressures and cues for drinking are unavoidable (Witkiewitz, Donovan, & Hartzler, 2012). Similar strategies may prove effective when engaging in weight loss treatment. Promoting food refusal skills may be an additional strategy to increase positive dietary behaviors when experiencing cues and social influence.

Furthermore, social support is a viable option to overcome the interference of social influence on positive health outcomes. Supportive involvement from family and friends has been linked to long-term adherence of goals related to diet and exercise (Sallis, Grossman, Pinski, Patterson, & Nader, 1987; Treiber et al., 1991). Wing and Jeffery (1999) conducted a 16-week experimental weight loss intervention in which participants were recruited either alone or with 3 friends or family, then subsequently randomized to standard behavioral treatment (SBT) or SBT with social support strategies. Participants entering treatment with support members demonstrated greater adherence and weight loss than individuals recruited alone, while participants in the SBT plus social support condition showed greater adherence (98%), lost the most weight upon completion of the intervention, and demonstrated better maintenance of the weight lost 10-months post-treatment. Social support involvement likely encourages behaviors related to attaining health-related goals. Although including family and friends in weight loss treatment is not always feasible, informing social supports of weight loss goals may serve as a protective factor against the negative effects of social

influence on health behaviors. Future research examining the relationship between social interactions and healthful eating is clearly warranted.

Cooking Ability and Knowledge. Hypotheses related to confidence in cooking ability and knowledge of recipes were not supported. In fact, these barriers were excluded from analyses as the limited number of endorsements prevented adequate power from examining barriers related to home-food preparation. Post-hoc analyses, however, revealed that individuals unwilling to invest time and energy in food preparation were less likely to consume home-prepared food. While this measure does not capture cooking skills and knowledge, avoidance of food preparation may reflect difficulties related to cooking ability. It is possible that cooking skills and knowledge of recipes may not have been salient to participants in the current study; individuals who do not regularly engage in food preparation may not be aware of their competence in this area. Moreover, given that time was endorsed as one of the greatest barriers to preparing and consuming home-prepared food, perhaps, time may have overshadowed deficits in cooking ability and knowledge of recipes as being perceived as barriers. For example, the amount of time required to prepare home-made foods could be overestimated due to limited cooking ability, thus leading to consumption of away-from-home food sources. Nevertheless, cooking ability and knowledge of recipes were not significant barriers in the current study.

Strengths and Limitations

The use of EMA is a strength of this study. This novel data collection method allowed for assessment of dietary behaviors while avoiding retrospective recall. To our knowledge, this is the first study to examine food preparation behaviors immediately

following eating episodes across a 14-day period. While it is unclear if home-prepared food is an effective component for future weight loss interventions, the current study bridges a gap in the current literature by examining the momentary environment related to the consumption of home-prepared food. Further, the design of this study allowed for within and between-person examinations regarding perceptions related to consuming home-prepared food. These findings highlight the positive internal experiences related to consuming home-prepared food. Taken together, the findings from this study highlight the plausible benefits of food preparation on weight loss outcomes, as well as the impact on the potential feasibility of this behavior as it relates to participant perceptions (i.e., goal consistency, diet maintain, diet success).

It is also important to acknowledge the limitations of the current study. While also a strength of the study, the use of EMA may also be considered a drawback. Items used for the EMA were not validated measures and were developed using prior research in the area of food preparation. Items may not have captured important factors associated with food preparation. It is also possible that participants did not fully distinguish between homemade versus prepared foods. Participants were informed which ingredients and foods were considered home-prepared during the introductory face-to-face orientation, though the abundance of convenience foods and ready-made meals may have been difficult to discern. For example, many convenience meals are frozen or prepared ahead of time that require minimal preparation such as heating. Thus, effort involved in preparing these foods, albeit minimal, could lead individuals to regard convenience foods as home-prepared. In addition, these foods are often presented as healthy choices (e.g., fat-free, sugar-free, all-natural), yet include many

energy dense ingredients and have been associated with increased BMI (van der Horst et al., 2010). Thus, perceptions of preparing convenience foods as home-prepared meals may have subtly influenced weight loss outcomes associated with consuming home-prepared meals following the intervention.

The characteristics of the study sample could also limit the generalizability of the findings. Participants in the current weight loss intervention were recruited from a rural university town in the southeastern United States, and it is unclear if individuals in urban areas and other regions of the country would have similar experiences. The demographics of participants may have also skewed the results towards individuals of a higher education and socioeconomic status. In addition, the small sample size and significant attrition likely limited the generalizability and interpretation of the findings. Additional studies with a larger sample and higher levels of program adherence are needed to determine the reliability of the findings.

Finally, the current study did not examine the ingredients of home-prepared meals which may have shed more light on the meals reported during the EMA period. For example, although foods prepared in the home are considered healthier compared to food from other sources, home-prepared meals comprised of high fat, fried, and calorically dense foods could plausibly be comparable or even unhealthier to those found in restaurants and fast-food establishments. A closer examination of the quality of home prepared foods versus food prepared outside of the home would have been important but were beyond the scope of this investigation. The current study was conducted in conjunction with a larger study examining experiences of nutrition monitoring; however, the link between EMA and content of home-prepared food cannot

be determined due to food entries entered without a time stamp. Thus, it is not feasible to link EMA entries to meals monitored. Nevertheless, in addition to trending toward greater weight loss, within-subjects analyses demonstrated greater perceptions of meeting nutrition goals, success with one's diet, and ability to maintain one's diet during eating episodes when consuming home-prepared food.

Future Directions and Concluding Remarks

Planning and management of food preparation is considered an important component of food literacy as it has the potential to affect healthful eating and weight loss goals (Vidgen & Gallegos, 2014). The current study demonstrated some potential benefits of home-prepared food consumption on weight loss outcomes. In addition, participants perceived greater consistency with their nutrition goals, ability to maintain their diet, and success with their diet when consuming home-prepared food.

Further, the current weight loss intervention provided cognitive-behavioral content designed to develop weight loss skills and strategies (i.e., physical activity, problem-solving, caloric content), yet did not provide information for preparing home-made meals and the associated improved health outcomes. Interventions targeting barriers to home-prepared meal consumption while incorporating perceptions related to meal preparation behaviors may increase the consumption of more healthful meals prepared in the home compared to other sources. This is another important area for future research.

Overweight and obesity are associated with numerous risk factors for health and well-being and continue to be a global concern. Although preliminary, encouraging the

consumption of home-prepared food may be a viable option for improving weight loss outcomes among treatment seeking adults. More research in the area of dietary behaviors related to healthy eating is needed to enhance the effectiveness of current behavioral weight loss interventions.

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Appendix A: IRB APPROVAL



EAST CAROLINA UNIVERSITY

University & Medical Center Institutional Review Board Office

4N-70 Brody Medical Sciences Building · Mail Stop 682

600 Moyer Boulevard · Greenville, NC 27834

Office 252-744-2914 · Fax 252-744-2284 · www.ecu.edu/irb

Notification of Initial Approval: Expedited

From: Social/Behavioral IRB
To: [Chelsey Solar](#)
CC: [Robert Carels](#)

Date: 12/16/2016
Re: [UMCIRB 16-001899](#)
On Track

I am pleased to inform you that your Expedited Application was approved. Approval of the study and any consent form(s) is for the period of 12/16/2016 to 12/15/2017. The research study is eligible for review under expedited category # 4, 7. The Chairperson (or designee) deemed this study no more than minimal risk.

Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The Investigator must adhere to all reporting requirements for this study.

Approved consent documents with the IRB approval date stamped on the document should be used to consent participants (consent documents with the IRB approval date stamp are found under the Documents tab in the study workspace).

The approval includes the following items:

Name	Description
Barriers to Weight Loss	Surveys and Questionnaires
Binge Eating Scale	Surveys and Questionnaires
CESD	Surveys and Questionnaires
Demographics	Surveys and Questionnaires
Dissertation Proposal	Study Protocol or Grant Application
EMA for food prep	Surveys and Questionnaires
EMA for Monitoring	Surveys and Questionnaires
Food prep measures	Surveys and Questionnaires
Informed Consent 11.14	Consent Forms
Newest Vital Sign	Surveys and Questionnaires
Pre-screening survey	Recruitment Documents/Scripts
Recruitment Flyer	Recruitment Documents/Scripts
Recruitment Script	Recruitment Documents/Scripts
TFEQ-18	Surveys and Questionnaires
Weight Bias Internalization	Surveys and Questionnaires

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

IRB00000705 East Carolina U IRB #1 (Biomedical) IORG0000418
IRB00003781 East Carolina U IRB #2 (Behavioral/SS) IORG0000418