Want to Get Healthier?:

An Evaluation of Virtual Behavior Interventions on Increasing Healthy Lifestyle Choices

Kristin E. McCoy

A Dissertation Proposal Submitted to the Faculty of

The Chicago School of Professional Psychology

In Partial Fulfillment of the Requirements

For the Degree of Doctor of Philosophy in Psychology

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Abstract

Overweight and obesity are health issues that have been a topic of both basic and applied research for over 50 years. These are preventable health conditions that affect millions of people across the world. The industry for weight loss is astronomically large, yet overweight and obesity rates continue to rise despite the countless programs that promise results. Standard behavioral treatment for weight loss includes reduced caloric intake, increased physical exercise, and training in behavioral strategies. The types of behavior strategies used in research have included self-monitoring, cognitive restructuring, stimulus control, and goal setting, to name a few. Although a significant amount of research has been conducted to evaluate weight loss, the behavior strategies used to achieve weight loss goals are still unclear. The purpose of this study is to evaluate the effects of self-monitoring and virtual social interaction on weight loss and improved health outcomes.

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Chapter 1: Nature of the Study

Background

Overweight is defined as having a body mass index (BMI) of 25.0 to 29.9; whereas *obesity* is defined as a BMI of greater than 30.0 (Center for Disease Control [CDC], 2020). The adult obesity rate in the United States is 42.4%, a 26% increase since 2008 (CDC, 2020). An additional 32% of Americans are categorized as overweight, meaning that nearly **two-thirds** of Americans are overweight or obese (CDC, 2020). Because of the correlating health conditions such as heart disease, type 2 diabetes, and some forms of cancer (Pedersen et al., 2017), overweight and obesity are matters of public health. Obesity is often broken down into three classes: Class 1 is a BMI of 30.0 to 34.9, Class 2 is a BMI of 35.0 to 39.9 and Class 3 a BMI of greater than 40.0, also defined as extreme or severe obesity (CDC, 2020). In the United States, one in five deaths is associated with obesity (Laidman, 2013).

A modest loss of 5-10% of a person's bodyweight can decrease risk factors for chronic diseases related to obesity (CDC, 2020). Behavioral weight loss programs are designed to help patients lose 1-2 pounds per week, resulting in a 5-10% decrease in body weight over six months (Olson et al., 2017). *Lifestyle interventions* have been associated with long-term benefits such as improvements in blood pressure, cholesterol levels, and decreased incidence of type 2 diabetes (Lemon et al., 2016).

Standard behavioral treatment (SBT) of obesity has been used in clinical trials for over two decades (Sun et al., 2019). They key components of SBT are a) dietary modification, b) increased physical activity and c) behavior strategies (i.e., self-monitoring, stimulus control, goal setting, and problem solving) (Olson et al., 2017, Pinto et al., 2007). Research regarding weight loss has typically included these three key components (e.g., Olson et al., 2017, Pinto et al.,

2007, Lemon et al., 2016)., often focusing on one component individually rather than all three as a treatment package (e.g., Zheng et al., 2018, Pedersen et al., 2018) and is often conducted in a clinical setting (i.e., hospitals and treatment centers) through in-person weight loss treatment groups (Lemon et al., 2016).

In this paper we will first discuss some of the important reasons for studying effective weight loss and health improvement interventions. Second, we will discuss research on weight loss and how it is currently studied. Next, we will discuss research related to subtopics that can influenced weight loss and maintenance research, including self-management and feedback. Finally, we will propose a blending of these strategies to evaluate the effectiveness of virtual behavior strategies on weight loss and improved health outcomes.

Problem Statement

Obesity, defined as having a BMI of >30, is a significant epidemic across the United States of America, with a prevalence of 42.4% in 2017-2018, a more than 12% increase since 1999-2000 (CDC, 2020). Approximately 62% of women in the USA are overweight or obese (Pinto et al., 2017). Obesity not only impacts a person's health, but the cost of medical treatment impacts taxpayers on a national level. The estimated annual health care costs of obesity-related illnesses are a staggering $210 billion (Cawley & Meyerhoefer, 2011). Conversely, the weight loss industry is a $190 billion industry, promising drastic change in short periods of time using pills, wraps, juices and severe caloric restriction.

Overweight and obesity statistics are concerning in and of themselves, but coupled with the onset of a global pandemic, this issue is hard to ignore. The COVID-19 pandemic has disproportionally impacted those who are overweight or obese, as obesity is associated with decreased expiratory reserve volume, functional capacity and respiratory system compliance

(Dietz & Santos-Burgoa, 2020). Additionally, those with significant abdominal obesity are further impacted, as further pulmonary complications can make ventilation more difficult (Dietz & Santos-Burgoa, 2020). COVID-19 has more significantly impacted those who have underlying health conditions versus those who are generally healthy when contracting the disease. The CDC found that 89% of pre-existing conditions were those related to overweight and obesity (Finer et al., 2020). Obesity makes treatment of COVID-19 more challenging, as there are weight restrictions on the machines used to evaluate lung functioning, transfer of overweight patients is more difficult and the ventilation process for those who are overweight or obese can be more complex for medical professionals (Finer et al., 2020).

The way that people have lived their lives has changed from the pandemic to prevent the spread of the disease (CDC, 2020). During the height of the spread of COVID-19, businesses, were shut down and people were encouraged to remain isolated from others to avoid close contact of the disease. *Social distancing* has become a mainstream term and is associated with personal safety and the safety of others (O'Brien, 2020). COVID-19 restrictions have limited access to resources such as fitness centers and gyms, attendance at in-person weight loss program meetings and to grocery stores and healthy food options. This place where an existing medical epidemic and a new national pandemic collide is a perfect storm of severe risk for those affected. Not only do preexisting conditions such as obesity impact a person's prognosis when diagnosed with COVID-19, there is mounting evidence that obesity is a major independent risk factor for severe illness or mortality from COVID-19 (Hinchcliffe et al., 2020).

COVID-19 not only impacted those who were obese and overweight negatively if it was contracted, but there was also a significant increase in weight gain during shutdowns associated with COVID-19. In fact, a survey conducted by the American Psychological Association in

February of 2021 found that 61% of adults experienced unwanted weight gain during the shutdown (APA, 2021). A 2021 study of children and adolescents between the ages of 2 and 19 showed that the monthly rate of increase in BMI nearly doubled during the COVID-19 shutdown compared to pre-pandemic time period (Lange et al., 2021). This further solidifies the need to address health outcomes, as the behaviors modeled by adults are then replicated by children, leading to yet another generation of people with high rates of obesity and associated health conditions.

Traditionally, weight loss treatment included face-to-face interventions in individual and/or group settings; however, modalities of implementation have expanded to evaluate the use of virtual interaction rather than face-to-face interactions (Chambliss et al., 2011, Lemon et al., 2016). This current research shows positive outcomes in the use of telehealth, further supporting the use of virtual weight loss treatment amid a global pandemic where face-to-face interaction was not possible.

Purpose of the Study

This study aims to evaluate the effects of behavior standard behavior treatment in a solely virtual modality on weight loss and improvement of overall health outcomes. These findings will help provide direction to those implementing behavioral weight loss strategies following SBT for weight loss in a virtual setting. Previous research explains that SBT includes reduced caloric intake, increased physical activity and training in behavioral skills such as tracking daily food intake, daily weighing, and reporting (Pinto et al., 2007; Olson et al., 2007)., There is limited research on the specific details of the implementation of the behavior skills utilized to impact weight loss and overall health outcomes. Many articles reference behavioral strategies, but do not place these strategies at the forefront of the interventions used in the study, often focusing

more on dietary changes and physical activity. For this reason, this study isolates the behavioral skills component rather than addressing all three components of SBT as most research does.

Many weight loss treatment programs require a live attendance component. Weight Watchers, for example, is one of the most well-known commercial weight loss programs and is built around live weekly meetings and weigh-ins (Djuric et al., 2000). A virtual intervention would afford participants more flexibility and ease of use than the requirement of live attendance. Due to the current COVID-19 pandemic, social interaction has moved from live and in-person to virtual, using platforms such as Zoom, FaceTime, GoToMeeting, etc. (Brown et al., 2020). Zoom users spiked from 10 million in December 2019 to 200 million in March of 2020 (Evans, 2020). Data on how social reinforcement can be accessed virtually can impact weight loss and health outcomes, providing a better understanding of the behavior strategies utilized in SBT.

The current research included participants who are defined as overweight or obese, meaning a BMI of 25 or higher (CDC, 2020). They reported their weight daily, based on data recorded in the Gennec App. Data across conditions showed if weight loss increased more quickly or more slowly dependent on the implementation of behavior strategies versus no behavior strategies in place. Because obesity and overweight are considered epidemics in the United States (CDC, 2020), it is important that individuals are equipped with the best information possible surrounding not only the steps to take to lose weight, but how to specifically implement those steps and how accountability and feedback impact results.

Research Questions and Hypotheses

The guiding question for this study was as follows: What is the impact of implementation of specific behavior strategies in a virtual setting on improved health outcomes in those with overweight or obesity? This was then broken into the following sub-questions:

- Will virtual SBT decrease participants' weight?
- Will virtual SBT affect participants' eating habits?
- Will virtual SBT affect participants' water drinking habits?
- Does SBT implemented in a virtual setting have the same effects on weight loss as SBT in a face-to-face setting?

It was hypothesized that the implementation of specific behavior strategies could lead to improved health outcomes and weight loss.

Definition of Key Terms

Feedback. Feedback includes multiple components: data review, praise for correct implementation, corrective feedback and addressing questions or comments (Codding et al., 2005).

Obesity. Obesity is defined as having a Body Mass Index of >30 (CDC, 2020).

Overweight. Overweight is defined as having a Body Mass Index of 25 to <30 (CDC, 2020).

Self-Monitoring. Self-Monitoring is defined as repeated self-observation, evaluation**,** and recording of one's own behavior (Olson, 2011).

Social Distancing. Social Distancing is defined as keeping six feet or more from people not in one's immediate household (CDC, 2020).

Standard Behavioral Treatment. Standard Behavioral Treatment is comprised of three components: calorie restriction, physical activity and behavioral strategies (Olson, 2017).

Significance of the Study

Overweight and obesity are seriously public health issues in the world, impacting 39% and 19% of the population, respectively (World Health Organization [WHO], 2020). From a health perspective, the average medical cost for a person who has obesity was nearly $1,500 higher in 2008 than for a person of average weight. Additionally, the COVID-19 pandemic has disproportionally impacted those who are overweight and obese compared to those of average weight. The CDC found that 89% of pre-existing conditions that can make COVID-19 more severe were those related to overweight and obesity (Finer et al., 2020). During the shutdowns related to COVID-19 in 2020, over half of adults surveyed reported unwanted weight gain during the shutdown, with an average of 15 pounds gained during this time (APA,2021). To further complicate the challenges that have come with this global pandemic, gyms and fitness centers were forced to close and nearly all social interaction was moved to virtual, thus decreasing a person's ability to engage in exercise and in in-person health and weight loss programs.

This study is significant in that it can help participants lose weight but can also address the exorbitant cost of obesity and weight loss. It can also address the complications of weight gain, greater risks of complication and even death, and inability to have face to face meetings brought on by the global pandemic. Additionally, successful weight loss can lead to improved health outcomes, reducing the need for medical intervention to treat obesity-related diseases such as type 2 diabetes and heart disease. This research can provide information for practitioners in creating plans to address overweight and obesity.

Summary

Overweight and obesity are preventable health diagnoses that increase risk of cardiovascular disease (Field et al., 2001), type 2 diabetes (Stein & Colditz, 2004) and some

forms of cancer (Calle et al., 2003). Weight loss is a 16-billion-dollar industry (WHO, 2020), yet those who purchase weight loss programs that promise a ‘quick fix’ have limited success in losing weight initially or difficulty in maintaining weight loss (Pedersen et al., 2017). The purpose of this study is to evaluate the effects of behavior strategies in a virtual setting on weight loss and improved health outcomes. This is significant for several reasons. First, a better understanding of successful weight loss treatment could lead to a reduction in obesity-related medical conditions which could, in turn, lead to a reduction in the medical costs of overweight and obesity. Additionally, this study could help provide clinicians and practitioners with a greater understanding of implementation of standard behavioral treatment in a virtual setting.

Chapter 2: Review of the Literature

Obesity is a major health care priority, as it is associated with an increased risk for Type 2 diabetes, cardiovascular disease, hypertension and other diseases (Douketis et al., 2005). Not only is this a priority because of the medical ramifications, but the cost of overweight and obesity is exorbitant for both the individual and for the government and the cost continues to climb (CDC, 2020). The following chapter will expand on the topics introduced in Chapter 1, providing an analysis of existing literature and evaluation of gaps and limitations.

This chapter will provide information on SBT and will also highlight how the behavior strategies used in weight loss treatment are often referenced in research, but seldom clearly described. A *weight-loss strategy* often referenced in the literature is self-monitoring, which can include daily recording of weight and/or food and beverage intake (Pinto et al., 2017; Olson et al., 2007). The topic of feedback, including electronic feedback (Chambliss et al., 2011, Oshima et al., 2011) and immediate feedback (Codding et al., 2005), is also briefly discussed in weight loss literature. To understand the history of weight loss research and to identify gaps in the current literature, The Chicago School of Professional Psychology's library was searched using the key terms "weight loss", "feedback", "standard behavior treatment", "self-management" and "self-monitoring".

Standard Behavioral Treatment

When considering weight loss from a behavioral standpoint, the reinforcement contingencies at play are important to understand. Because reinforcement, also known as the increase of behavior, is most effective when it is provided directly after a behavior occurs, it can be difficult to adequately reinforce weight loss, as change is not immediate. Because humans often seek out immediate reward versus delayed benefit (Volpp et al., 2015), weight loss can be a

significant challenge. The immediate gratification of the taste of a preferred food item often outweighs the delayed reward of reduced weight and increased health benefits.

One study attempted to address immediate reward by using a financial incentive. The study equated weight loss to financial gain, resulting in a positive result for those receiving money for pounds lost. Volpp et al. (2015) separated 57 participants into three groups: monthly weigh-ins/control group, a lottery incentive group, and a deposit contract with matching group. The only expectation of the control group was to go to the weight loss clinic and weigh in at the first of the month. All participants from the lottery group and deposit contract group were to weigh in daily and call a designated number to report their weight. The lottery incentive program group provided participants with a printout of expected weight loss each day. If their weight was at or below the expected number for the day, they were then entered into a lottery where they could receive either an infrequent large payout, a more frequent smaller payout, or no payout. The deposit contract group was also provided with a printout of expected weight loss each day. At the beginning of the month, these participants contributed a designated amount to their personal bank, anywhere from $0.01 to $3 per day. Additionally, a matching option was provided by the researcher, up to $3 per day. If these participants weighed in daily at or below the expected weight loss provided at the beginning of the month, the participant would receive that amount of money. Both the lottery group and the deposit contract with matching group lost significantly more weight than the control group with a mean of 14 pounds and 13 pounds, respectively. Approximately 50% of the participants in the treatment groups lost the goal amount of 16 pounds whereas only 10% of those in the control group lost that amount. These results demonstrated that the use of an economic incentive system produced significant weight loss during the 16-week study.

Standard behavioral treatment (SBT) for weight loss focuses on changing diet, physical activity and behavior skills to promote weight loss and weight-loss maintenance (Pinto et al., 2007). Weight loss maintenance, defined as maintaining weight loss that occurred during SBT for 6-12 months (Pedersen et al., 2018), is often unsuccessful. Participants in weight loss treatment groups regain an average of 35% of weight lost within the first year and often return to their starting weight within 5 years of the termination of treatment (Young et al., 2014).

SBT is broken down into three goal categories, the first being dietary goals. These are often defined as low-calorie/low-fat diets, reduced caloric intake and a reduction of the percentage of calories from fat in one's daily food intake (Pinto et al., 2007). The second category is physical activity goals, defined as moderate-intensity aerobic activity such as brisk walking, gradual increase of activity to 150-200 minutes per week, exercise a minimum of 5 days per week and an increase in overall lifestyle activity such as parking further from the entrance at the store. The third category if the implementation of behavior skills, which can include self-monitoring, stimulus control, goal setting, problem solving and cognitive restructuring (Pinto et al., 2007).

A review of current research evaluates the outcome of behavioral weight loss treatments, assessing the outcomes based on each component of SBT. (Pinto et al., 2007). To address the dietary goals component, the use of meal replacements (Hannum et al., 2004), food provision (Wing et al., 1996), and very low-calorie diets (Gilden &Wadden, 2006) were evaluated. A meta-analysis conducted by Pinto et al. (2007) showed that while each of these interventions resulted in initial weight loss significantly higher than those who were not using one of these dietary restrictions, all participants regained weight within 6 months of treatment and weight was only slightly lower than a no-treatment control condition (Pinto et al., 2007, Douketis, 2005).

Evaluation of the physical activity (PA) component of SBT found that, although most SBT programs typically prescribe a *gradual* increase in PA, few data-based studies support this goal and in fact suggest that more instantaneous increases in levels of PA appear to be more beneficial for long-term weight loss (Pinto et al., 2007). Similarly, Olson et al. (2017) defined the key components of a behavioral weight loss program as calorie restriction, physical activity and behavioral strategies. Interestingly, neither Pinto et al. (2007) or Olson et al. (2017) explained in detail the behavioral strategies used to facilitate weight loss. Although both authors list self-monitoring, stimulus control and goal setting as behavioral strategies as a component of SBT, they do not provide a review of the technological application or theoretical importance of these strategies. These articles lack an analysis of the role behavioral strategies play in facilitating weight loss and weight loss maintenance.

Sedentary behavior, or lack of physical activity, is an important predictor of health outcomes (Kerrigan et al., 2018). While physical activity is one of the three components of SBT, little research focuses on changes in sedentary behavior during behavioral weight loss programs. Kerrigan et al. (2018) sought to evaluate how changes in sedentary behavior impacted weight loss and cardiovascular health. Participants of this study engaged in basic weight loss treatment through two programs, Diabetes Prevention Program and Look AHEAD. Additionally, participants wore accelerometers to measure movement of each participant. Results of the study found that changes in sedentary behavior did not follow a particular trend but was very much based on each individual participant. While some had an overall increase in activity, others had an increase in physical activity at a specific time, but an overall increase in sedentary behavior on average throughout the day. A more prescriptive approach to changes in sedentary behavior was recommended to evaluate the impact of physical activity on weight loss.

The final component of SBT, the primary focus of this study, is behavior strategies. A qualitative study by Metzgar et al. (2014) provides clarity on the behavioral strategies that both assist and deter weight loss. This study used focus groups to explore *facilitators*—activities that are likely to promote weight loss such as family support and removing unhealthy foods from the house-- and *barriers*—activities that are likely to hinder weight loss such as lack of family support, failure to meal plan-- to weight loss and maintenance of weight loss in women who had previously participated in a clinical trial for weight loss using an energy-restricted diet. The researchers sought to gather insights into participants' perceptions into weight loss and maintenance following the completion of a single intervention. 23 women participated in 7 focus groups where they were asked to answer 11 open-ended questions about weight loss after participation in weight loss studies. The answers were then used to create an analysis for common weight loss *themes*— those things that either served as facilitators or those that acted as barriers. The identified facilitators were accountability to others, social support, planning, awareness and mindfulness of food choices, basic nutrition education, portion control, exercise and self-motivation. Accountability to others and social support work in tandem in successful weight loss, as accountability and social support can help a person remain motivated to reach their goals (Metzgar et al., 2014). Accountability and support can be implemented many ways. In the research on weight loss and weight loss maintenance, accountability and support are typically provided in face-to-face clinical environments (Metzgar et al., 2014). More research, however, is needed to evaluate the effects of virtual social interaction on weight loss and weight loss maintenance. Planning is inherently linked to mindfulness and awareness of food choices and energy intake (Metzgar et al., 2014). Examples include packing a lunch rather than going to a restaurant with coworkers or making food decisions prior to big events such as holidays, social

activities and travel. The barriers identified were life transitions, health status changes, internal factors, environmental pressures, lack of accountability and absence of social support. Some examples of these barriers could include a move or a change in work and/or health issues such as a flu/cold disrupting weight loss effort. Absence of social support was reported by participants as other women who displayed negative reactions to weight loss efforts, such as making snide remarks about what the participant was eating or encouraging the participant to reward herself with a dessert (Metzgar et al., 2014).

By identifying factors that both facilitate and disrupt weight loss and maintenance of weight loss, this study helped to provide a strong conceptualization of aspects that impact weight loss success. This study provides suggestions for future research based on these facilitators and barriers. One suggestion is to provide or build a social support network, which is often lacking in weight loss studies (Metzgar et al., 2014), but *how* to do this was not addressed. The authors also suggest practicing and reinforcing planning skills during programs to enhance mindfulness of food intake and awareness of daily energy intake (Metzgar et al., 2014). Again, this is a strong suggestion for future research, but fails to identify *how* interventions could be implemented.

Just as Metzgar et al. (2014) identified accountability as an important facilitator to weight loss, Zheng et al. (2018) evaluated the effects of daily weighing, a form of accountability, among individuals who successfully lost weight during a 12-month weight loss study. Historically, the notion of daily weighing has been criticized, with reports of increased anxiety and depression and lowered self-esteem for those in a daily weighing group versus those in a non-weighing group (Ogden & Wyman, 1997). Consequently, daily weighing was rarely referenced in weight loss research before 2006. Since then, however, multiple studies have shown benefits of daily weighing, reporting that it was strongly associated with a higher proportion of successful weight

loss (e.g., Klem et al., 1997; Kruger et al., 2006; Welsh et al., 2009; Steinberg et al., 2013), providing support for daily weighing as a reasonable intervention for weight loss.

The purpose of Zheng et al. (2018) was not only to describe participants' experience of daily weighing, but to evaluate factors that influenced *adherence* to daily weighing among individuals who were successful in losing weight. Participants completed a year-long weight loss intervention study that included daily weighing using a Wi-Fi scale and were then recruited to in focus groups. From these focus groups, five main themes emerged a) reasons for daily weighing, b) reasons for not weighing daily, c) factors that facilitated weighing, d) recommendations for others about weighing daily, and e) suggestions for future weight loss strategy. Participants reported benefiting from daily weighing by feeling more in control of their weight as well as an increased awareness of food choices and daily physical activity. Reasons for not weighing daily included a disruption of routine such as a vacation and emotional reactions if the number on the scale increased (Zheng et al., 2018). One factor that facilitated daily weighing included ease of daily weighing, as it is only one time per day and takes only one minute. (Zheng et al., 2018). Although these authors concluded that daily weighing may help participants feel motivated and in control, they failed to evaluate the effects of daily weighing in conjunction with other standard behavioral treatment interventions.

Community based weight loss campaigns provide the ability to reach a larger number of people impacted by overweight and obesity (Wing et al., 2010). Shape Up RI, a community-based weight loss program based out of Rhode Island, sought to determine whether the inclusion of behavioral weight loss strategies would improve outcomes for participants. A total of 179 participants were included in Study 1 and 128 were included in Study 2. Study 1 aimed to determine whether including weekly lessons that taught behavioral strategies about healthy

eating and exercise would improve weight loss results. This was considered the 'standard' group. Study 2 included the addition of multimedia lessons plus an increase in self-monitoring and automated computer feedback. This group was considered the 'enhanced' group. The primary finding of this study was that adding multimedia lessons, self-monitoring and automated feedback to the Shape Up RI program increased the average weight loss of participants.

Although SBT includes behavioral strategies as the third component of weight loss treatment (Pinto et al., 2007) SBT researchers often provided very broad overviews of these behavior strategies rather than providing results based on specified behavior strategies. It is important to better understand the technological use and conceptual basis of self-management and self-monitoring for weight loss treatment.

Self-Monitoring

Behavioral Self-Monitoring (BSM) is repeated self-observation, evaluation and recording of one's own behavior and has been effective across a broad range of areas including a) reduction of problem behavior (e.g., Schreurs et al., 2003), improvement of healthful behaviors (e.g., Saelans & McGrath, 2003), and workplace safety and productivity (e.g., Olson et al., 2001). Additionally, researchers suggest there is a positive relationship between levels of BSM compliance and magnitude of behavior change (e.g., Olson et al., 2011). Self-monitoring has been identified as the cornerstone of behavioral weight-loss interventions (Laitner et al., 2016). Self-monitoring success was explored through the short- (i.e., weight *loss*) and long-term (i.e., weight-loss *maintenance*) impact of weight change among adults participating in a behavioral weight-loss intervention; specifically, the difference between the pattern of weight loss most commonly reported in the literature-clinically significant loss followed by regain of 33% to 50% of weight lost—and those who showed results that were significantly different than what is most

commonly reported (Laitner et al., 2016). Participants in this study had previously completed a 6-month behavioral weight loss program, consisting of a low-calorie prescribed diet, increased physical activity and training in behavior-modification strategies. Of the 234 women who completed the 6-month program, 152 participated in the successfulness evaluation and were put into a treatment group and a control group. During phase 1, participants in the treatment group were provided with self-monitoring logs and instructed to record daily food and beverage consumption that were reviewed during weekly meetings. Phase 2 was designed as a fading procedure, as participants were instructed to complete records for at least two weekdays and one weekend day each week, a step down from weekly logs. The control group was provided no instruction to complete logs or attend weekly meetings. The total number of days with written food records was summed for each participant during each phase of the study. This allowed the researchers to compare numbers of daily logs completed with the amount of weight lost. Implications of the study were that self-monitoring can play a key role in successful long-term weight management, because only participants with the highest rate of food log completion continued to lose weight after the initial intervention. Additionally, participants who had a greater opportunity to monitor and evaluate progress had increased opportunities to adjust their course of action. Simply said, the participants were able to make changes and modifications to their plan based on the data recorded. This provides strong support of the use of self-monitoring, both during the treatment phase and during weight loss maintenance.

One of the primary forms of self-monitoring described in relation to weight loss is that of daily weighing. Self-weighing is associated with greater initial weight loss (e.g., VanWormer et al., 2009) and with better long-term weight loss maintenance (e.g., Linde et al., 2011; Wing & Phelan, S., 2005; VanWormer et al., 2012; Lynch et al. 2018). Lynch et al. (2018) examined self-

monitoring behaviors in bariatric surgery patients and evaluated how self-monitoring behaviors contributed to post-surgery weight loss. In this study, thirty participants scheduled for bariatric surgery were recruited to participate in a year-long observational study of dietary and weight management behaviors. A self-monitoring questionnaire was used to gather information about how frequently a person engaged in self-monitoring behaviors such as "how often do you check your weight with a scale?" (p. 45). This questionnaire also included open-ended questions about reasons why a participant may or may not engage in self-monitoring behavior. Results of the analysis of this information indicated that bariatric surgery patients used a variety of different self-monitoring strategies, whereas participants used these strategies more frequently in the first 6 months compared to the last 6 months of the study. This study leads to the conclusion that dietary monitoring may be related to both short- and long-term weight loss outcomes. This study supports the use of daily self-monitoring behaviors to increase weight loss success.

One of the most vulnerable and heart-breaking populations affected are adolescents. In systematic review keyword searches using 'obese', 'weight loss,' 'adolescent,' and 'self-management' yielded 10 empirically evaluated self-management interventions among overweight and obese adolescents (Thomason et al., 2016). Researchers explain that weight loss maintenance is often poor, with participants in SBT regaining 33% of the weight lost in the first year and the rest in 3-5 years (Greaves et al., 2017). These statistics are even more challenging for adolescents, as this age group will have to work to maintain weight loss for longer periods of time than adults. Each of those studies showed that self-management of diet, physical activity positively influenced weight loss and weight management. The authors suggested interventions for adolescent weight loss should include teaching realistic a) goal setting, b) planning, and c) action taking. It is also strongly suggested to include relapse prevention strategies. Weight

management related goals are often defined in terms of weight itself, caloric intake, dietary configuration, and/or exercise level (Wang et al., 2015). Planning can include scheduling times for exercise or planning menus in advance (Young et al., 2014). Action taking is the combining and implementation of goals and planning. This can include exercising when scheduled or preparing food that has been previously planned.

Self-monitoring has been conceptualized as an agent for behavior change (Hartmann-Boyce et al., 2019) and has been found to lead to reduction in unwanted behaviors as well as increases in desired behaviors across a range of topics, including daily activity and weight loss (Butryn et al., 2007; Fletcher et al., 2015; Michie et al., 2009). Although ample research has been done on self-monitoring within the context of formal weight loss interventions, little has been conducted to address self-monitoring in *self-directed* weight loss attempts-attempts that are not formally designed and implemented by a doctor or clinic, but by the individual (Hartmann-Boyce et al., 2019).

A systematic review was conducted to examine experiences of self-monitoring as an aid to self-directed weight loss (Hartmann-Boyce et al., 2019). Seven databases were searched for qualitative studies using terms such as ‘obesity’, ‘weight loss’, ‘diet’ and ‘exercise’. Participant’s feedback on self-monitoring was reviewed and broken down into common themes. These themes included a) self-perception and emotions, b) attentive and reactive self-monitoring, and c) trust and deception. Regarding emotions and self-perception, it was often reported by participants that they were less likely to engage in self-monitoring behavior when they anticipated the recorded outcome could elicit a negative emotional response, such as the number on the scale increasing after a day of unhealthy eating (Hartmann-Boyce et al., 2019). Attentive and reactive self-monitoring is the process of not only recording information but analyzing it and then making

changes based on the analysis (Hartmann-Boyce et al., 2019). For example, one participant explained that when putting on a pair of pants that were too tight, it prompted her to evaluate potential reasons and ways to make behavior changes. When considering trust and deception in self-monitoring, participants seemed to make deliberate choices about what measures to use, some referencing that they preferred to weigh daily it provided definitive evidence of weight loss or weight gain (Hartmann-Boyce et al., 2019). An example of self-deception is a participant forgetting to record a dessert high in calories or intentionally underestimating the portion size (Hartmann-Boyce et al., 2019).

Hartmann-Boyce et al. (2019) provided insights into the implications of self-monitoring on weight loss and maintenance. Self-monitoring is not only a tool to increase adherence to behavior change targets, but also a tool for facilitating analysis and self-experimentation. This study provided insight into self-directed programs as opposed to formal weight loss programs and how self-monitoring in a self-directed program can improve outcomes. Self-directed weight loss strategies coupled with accountability can lead to positive results.

Feedback

Feedback has been a part of psychosocial and health behavior interventions for several years (Diclemente, 2001) and has been demonstrated in research to be an important component for establishing self-monitoring as an effective intervention (Freeman & Dexter-Mazza, 2004). When considering behavior change, feedback is a critical component of self-monitoring (Hartmann-Boyce, 2019).

The effects of personalized, immediate feedback on adherence to hand hygiene in three female occupational health clinic workers were evaluated in a study by Luke and Alavosius (2011). During baseline, participants received no feedback or instruction after completing hand

hygiene. During treatment sessions, the participants were provided individual, private, written and verbal feedback as soon as possible after observing contact with a patient. Results showed that all three participants increased adherence from baseline to intervention and maintained higher rates of adherence of hand-hygiene in the maintenance phase. These results support the theory that immediate, personalized feedback effectively increased and maintained improvements in hand hygiene. This study provides a greater conceptualization of the use of personalized and immediate feedback when using universal precautions, creating a pathway to expand to other socially significant behavior such as standard behavioral treatment procedures for weight loss.

Feedback has been identified as an important and effective component within technology-based weight loss interventions (Sherrington et al., 2016). The effectiveness of personalized feedback to those in a weight loss program compared to those who did not receive personalized feedback was evaluated using a systematic review (Sherrington et al., 2016). Nine databases were searched, and 12 studies were included. Some key words searched were ‘internet’, ‘computer’, ‘online’, ‘nutrition’ and ‘weight loss.’ Inclusion criteria included: adults with BMI greater than 25, interventions targeting diet and/or physical activity for weight loss, delivered at least in part via the internet and incorporating either human-delivered or computer-generated personalized feedback. These studies were analyzed using mean change for each intervention that provided personalized feedback and control group receiving no feedback compared with weight loss, BMI and percentage of weight loss. Of the 12 studies, 8 incorporated human-delivered internet feedback while 5 provided computer-generated internet feedback. Participants who received personalized feedback were two times more likely to achieve 5% weight loss than those in control groups. The results of this study suggested that personalized

feedback may be an important behavior change technique to include in internet-delivered weight loss interventions.

Feedback is further studied by delineating between computer-based and personalized, human-based feedback. Beleigoli (2020) sought to evaluate the effects of both computer-based and human-based feedback on a web-based behavior change platform. Participants were separated into three groups: the control group, where participants were given minimal, non-personalized intervention based on dietary and physical activity recommendations. The second group was provided full access to a web-based platform that provided dietary and physical activity recommendations, but also included behavior change techniques. Computer-generated, personalized feedback was provided to participants in group 2 based on goals set by the participants. The third group included all components of Groups 1 and 2, but also provided feedback and education by a dietician, referred to in the study as a coach. Feedback provided by the coach included a review of goal setting, promotion of self-monitoring and emotional social support. Results of the study showed that engagement in the platform plus coaching group was higher than the platform only group. The platform plus coaching group led to greater weight loss across 24 weeks than the other two groups. Although the platform plus coaching group led to greater weight loss, the difference between this and the platform-only group was minimal. These results further support the importance of feedback and its effects on weight loss, whether it be provided via computer or by a human.

Daily weighing is a form of feedback that has been a topic in weight loss research for decades (Klem et al., 1997; Kruger et al., 2006; Steinberg et al., 2013; Welsh et al., 2009; Zheng et al., 2018), but is researched in isolation rather than in conjunction with another intervention. Combining both self-weighing and feedback, the effectiveness of twice a day self-weighing

coupled with a visual feedback component was evaluated using a multiple baseline design (Oshima, 2013). In this study, participants were divided into two groups: Group 1 was instructed to self-weigh at the same time each day and Group 2 was instructed to self-weigh immediately after waking up and immediately before going to bed every day for 12 weeks. In addition, data for Group 2 were connected to a device which both the measured weight and target bedtime weight were displayed on an LCD during morning weighing. Measured weight and the difference between the weight and the target weight were displayed during bedtime weighing, providing visual feedback to Group 2 participants. Results found that average weight reduction was higher for participants in in the twice-a-day weighing plus feedback group versus for participants that were in the once-daily self-assessment group. These results support the theory that weighing combined with feedback may be a more effective treatment intervention than self-weighing in isolation.

Summary and Purpose

Previous literature provides a basic understanding of the SBT components needed to impact health outcomes for those struggling with being overweight or obese. Much of the literature already supports that self-monitoring is a catalyst in weight loss (Metzgar et al., 2014; Zheng et al., 2018). However, SBT references ‘behavioral strategies’ as its third component (Olson et al., 2017, Pinto et al., 2007), but typically fails to provide clear directions as to which behavioral strategies to use. One potentially beneficial strategy is providing immediate feedback. Feedback is an effective stand-alone procedure (Chambliss et al., 2011; Codding et al., 2005; Freeman & Dexter-Mazza, 2004), as it provides additional information regarding the behavior, leading to greater success (Freeman & Dexter-Mazza, 2004). Self-monitoring, however, is often researched without a feedback component. For example, many studies use daily recording of

food intake and/or daily weight (e.g., Lynch et al., 2018; Thomason et al., 2016; Laitner et al., 2016), but fail to include how feedback may impact the results. The purpose of the current study is to replicate and extend previous research by combining these behavioral interventions to evaluate the effects on weight loss and general health outcomes.

Chapter 3: Research Design and Method

Chapter Overview

Overweight and obesity are treatable conditions that, in 2016, affected over 3.9 billion people across the globe (World Health Organization, 2020 [WHO], 2020). Over 4 million people died from issues related to obesity in 2017, making overweight and obesity a public health concern (WHO, 2020). With an estimated annual cost of $147 billion, this is an epidemic that requires substantial research and intervention. The standard behavioral treatment for overweight and obesity is typically comprised of reduction of caloric intake, increased physical activity and training in behavioral strategies (Olson et al., 2017). Although prescribed caloric restrictions and physical activity in research studies are straightforward, current literature fails to fully describe and analyze the behavior strategies used within BST.

Research Questions and Hypotheses

The purpose of this study is to evaluate the impact of self-monitoring and virtual social interaction on overall health outcomes in persons who are overweight or obese. The guiding question for this study is as follows: What is the impact of implementation of specific behavior strategies in a virtual setting on improved health outcomes in those with overweight or obesity?? This is then broken into the following sub-questions:

- Will virtual SBT decrease participants' weight?
- Will virtual SBT affect participants' eating habits?
- Will virtual SBT affect participants' water drinking habits?
- Does SBT implemented in a virtual setting have the same effects on weight loss as SBT in a face-to-face setting?

It is hypothesized that the greater access to immediate feedback paired with increased social reinforcement can lead to improved health outcomes and reduction in overall weight.

Participants

This study included 3 participants-Darcy, Wendy and Freja- who were all over the age of 18, had a BMI of at least 27, and had not participated in a formal weight loss program in the previous three months. Participants must have had access to a smart phone as well as a mode of accessing social media sites and Zoom. The participant must have had the capability of sending and receiving text messages. Participants were excluded if they reported any condition that might confound findings (i.e., diabetes, pregnancy, history of weight loss surgery), planned to become pregnant in the next 4 months, had scheduled prolonged travel over the next 4 months, were being treated for a serious mental illness such as schizophrenia, or reported alcohol use of >4 drinks per day. Any participant weighing over 396 pounds was excluded, as that was the highest weight recorded with the scale used in this study. Participant's consent was obtained prior to participation in the study (Appendix B).

Ethical Assurances

Participants were recruited from social media sites including Facebook and Instagram. A social media post described the purpose of the study as well as the inclusion and exclusion criteria. It included a secure email address for the experimenter for participants to email interest. Any person who expressed interest via email then completed a prescreen questionnaire to determine eligibility based on the inclusion and exclusion criteria (Appendix A). Upon determination that a person met the eligibility criteria based on the prescreen questionnaire, the participant was presented with a consent form via email. All participants required a signed consent form prior to enrollment in the study. All participants were confidential. Data was

protected by using pseudonyms for all participants. Additionally, all data were transmitted using a password protected email account. Institutional Review Board approval was required prior to beginning any component of the study.

Materials

Each participant was provided with an iDoo ID-001 BMI Bluetooth Body Fat Smart Scale (Appendix C) and Janie Choi Smart Tape (Appendix D). The scale had a corresponding smart phone application (app) called Gennec which measures 13 areas to analyze body composition: weight, BMI, body fat percentage, body water percentage, muscle mass, fat-free mass, bone mass, basal metabolism, protein, visceral fat, body age, body shape, and body score. The tape also had a corresponding smart phone application called "Fitdays" which recorded the diameter of specific body parts (e.g., arms, waist, hips, thighs, etc.) in inches or centimeters. Screenshots of the app readings were provided to the researcher from the participant. These were be sent via secure email to provide a secure place to store these documents.

Facebook was used to provide an online forum for virtual interaction between participants, IOA data collectors and the researcher. A "group" was created for the participants where they were instructed to comment on a daily post created by the researcher.

Weekly virtual meetings took place via the Zoom platform. All meetings were recorded via Zoom capabilities and stored in a secure electronic folder.

Setting

All research took place virtually. Participants participated in the study anywhere they are able to access the internet. Participation was expected daily and required approximately 20 minutes per day. The study occurred over the course of 7 weeks.

Dependent Variable and Measurement

Most dependent measures were recorded via screenshots of the apps linked to the two measurement tools provided to each participant. *Weight* was recorded in pounds via the Gennec app and *measurements* around chest, upper right arm, upper left arm, waist, hips, left thigh, and right thigh were recorded in inches via the Fitdays app. These data were shared with the researched daily and weekly, respectively, via a secure email account.

Data were also collected on completion of daily wellness journals, participation in Facebook group daily and Zoom meeting weekly. *Completion* data were based on the daily completion of the daily wellness journal. The number of provided journals was divided by the number of requested journals and multiplied by 100%. *Group* or *participation* frequency data were collected by recording attendance to the scheduled zoom meetings. Attendance was defined as the participant attending the meeting via zoom and answered at least one question.

The daily journal (Appendix E) tracked ounces of water consumed by each participant. In addition, it tracked daily food and beverage intake with estimated volumes. Upon receipt of these wellness journals, the researchers assigned the foods to a category-either red, yellow or green foods. These categories were created by the primary researcher based on the Noom™ application, which focuses on caloric density, and information from the Mayo Clinic's website regarding energy density. The Noom™ app recommends focusing on the caloric density of foods versus total calories consumed throughout the day (Robinson-Walker, 2022). The more water a food has, the lower its caloric density, thus consumption of low caloric density foods leads people to feel fuller for longer (Robinson-Walker, 2022). Energy density is the number of calories, or energy in a given volume of food (Mayo Clinic Staff, 2020). The higher the energy density of a food, the more calories in a smaller volume of food. Eating foods with lower energy density allows a person to eat more food while consuming a smaller number of calories (Mayo

Clinic Staff, 2020). Said another way, all calories are not created equal. Raisins, for example, have a higher energy density than grapes. A cup of raisins has four times more calories than grapes, making grapes the better choice from an energy density standpoint. *Red foods* were identified as those with a high caloric and energy density such as candy bars, fried foods and sweets. *Yellow foods* were those that had a moderate caloric density such as protein supplements, legumes and lean meats. *Green foods* were identified as those that are whole, natural foods that contained only one ingredient such as chicken, apples, broccoli. Green foods had the lowest caloric and energy density.

Interobserver Agreement and Treatment Integrity

To determine interobserver agreement (IOA), a second graduate research assistant (GRA) independently evaluated 33% of participant submitted screenshots, journal entries, Facebook comments, and Zoom meeting recordings using the total method in which the smaller number of responses was divided by the larger number of responses and multiplied by 100%. The average for Darcy and Wendy was 100% and 96% (range, 94-100%) for Freja.

Treatment integrity data were collected by the same GRA. A schedule of Facebook prompts was provided to the GRA, and she recorded if the text or prompt was provided by the researcher on schedule. The number of provided texts or prompts was divided by the total number of texts or prompts and multiplied by 100%. The total for treatment integrity was 98% (range, 95-100%).

Interobserver Agreement and Treatment Integrity Training. The research assistant was trained on the dependent variables using Behavior Skills Training, in which the researcher provided the 1) written definitions and study protocols, 2) model data collection, 3) example screenshots and videos for practice data collection, and 4) feedback on practice data collected.

Once the second researcher collects data with 90% reliability, they were provided access to participant records to review.

Experimental Design

A reversal design was used in this study, beginning with two weeks of baseline data. This design was chosen because the study included a single group. Additionally, the alternating of treatment and baseline conditions attempted to counteract the confounding effects of treatment. Research began with two weeks of baseline data, then intervention was implemented for two weeks, with a return to baseline for one week. The research ended with intervention that was implemented two weeks, making the study seven weeks long.

Reversal designs are sometimes criticized for returning to baseline as it could be harmful to the participants to cease intervention. In this case, however, the participants were not at risk for harm when the intervention was not in place. Had a participant been showing signs of harm such as symptoms of a heart attack or other significant medical complications, the intervention would have remained in place for that individual.

Procedures

At the start of the study, each participant received a one-page document that provided a description of the steps of how to use each tool provided and how to send the necessary screenshots to the researcher (Appendix F).

Each day, the participant stepped on the scale immediately upon waking and emptying bladder and/or bowels while wearing only undergarments. Prior to stepping on the scale, the participant opened the Gennec app on their smart phone and clicked the ‘bluetooth device is offline’ button to begin the data collection process. The participant remained on the scale until the display no longer showed a number and went dark. At that point, the data were automatically

transferred from the scale itself to the app. Each day, participants sent a screenshot of data from the Gennec app to the researcher using an encrypted email account.

Each week, the participant paired the Jane Choi tape measure with the Fitdays app. The participant measured each body part when prompted by the app. After completing the measurement of each body part, the participant pressed the Save button at the bottom to save all data. The participant then clicked "chart" on the home page of the app, then clicked the ruler icon in the upper right corner. Upon completion of all measurements, participants sent a screenshot of data from the Fitdays app to the researcher using an encrypted email account.

Baseline. During baseline, there were no required responses beyond providing daily weigh-in screenshots and weekly measurement screenshots. Receipt of the screenshots was not acknowledged by the researcher

Intervention. The intervention phase for this study included three primary components: completion of a daily wellness journal, daily participation in a Facebook group and weekly attendance at Zoom group meetings. Participants were required to submit a daily record of their food and beverage intake including the type of food or water and the amount of each. It also recorded any exercise completed during that day as well as a log of the participant's mood. This was completed using the "notes" application on their smart phone, via paper and pencil or electronically. At the end of each day, the participant sent this log to the researcher via a password protected email address.

The evening prior to the onset of intervention, each participant received a Facebook group invitation to a private group designated for this study. The group included all three study participants as well as two IOA data collectors who were graduate research students with the Chicago School of Professional Psychology. Participants were not told what to share but were

told this group was “to provide you additional support on your weight loss journey”. Participants were informed that a post would be added to the Facebook group daily and each participant was required to respond to the post in the comment section.

Each day, the researcher posted an inspirational message, daily question, or a challenge for participants. The researcher responded to participants’ posts with answers to questions or encouraging statements. Each participant was instructed to respond to the daily post by either answering the question or simply acknowledging receipt of the information. An example post said, “when you read this, drink a glass of water and then comment when you are done!”.

One time per week, participants logged in to a Zoom meeting with the group for a 30 minute live virtual meeting. Participants were not told what to discuss during the Zoom calls, but the researcher directed the conversation based on information in the daily journals. Participants were asked to set a weekly goal at this meeting. At the following meeting, participants revisited the weekly goal and discussed their progress toward this goal. Feedback was provided on information obtained through the daily wellness journals. The researcher responded to all questions from the participants and provided praise and encouragement based on the participant’s submitted screenshots and discussions.

Chapter 4: Findings

Introduction

The findings from this study offered the opportunity for a direct comparison of virtual behavior treatment for weight loss to no intervention. The various phases included baseline, two intervention phases, and one return-to-baseline phase.

Results

Overall results of the study are demonstrated through Figures 1, 2, and 3. Figures 4, 5, and 6 show the types of food consumed broken down by percentage and ounces of water consumed each day. Baseline intervention lasted for two weeks, where participants were asked to only weight themselves daily and measure all body parts weekly. Treatment intervention included participants completing a daily wellness journal, participating in a daily Facebook group, and attending a weekly zoom meeting. The treatment returned to baseline for one week and then concluded with two final weeks of intervention. All participants had a decrease in overall weight over the course of the seven-week study. Each participant's weight fluctuated throughout the duration of the study with many factors hypothesized such as menstrual cycles, illness, receipt of vaccinations, holidays, and travel. Additionally, all participants reduced overall inches of body parts measured.

Darcy

Results for Darcy are visually represented through Tables 1 and 4 and Figures 1 and Figure 4. Figure 1 shows that her weight started at 157.9 and ended at 154.9, resulting in a 3-pound weight loss during the study. Table 1 shows that Darcy decreased inches in her neck, shoulder, arms, waist, hips, thighs and by 2.5 inches, 1.3 inches, 1.6 inches, 2.9 inches, 5.9 inches, and 1.2 inches, respectively. She increased chest inches by 0.4 and remained the same

with thigh measurements, resulting in a total reduction of 15 inches. Figure 4 shows that Darcy had a decrease in the consumption of red foods and an increase in the consumption of water during the treatment phases. When evaluating results from a statistical perspective, the comparison of red foods and weight and green foods and weight are represented in Table 4. During the first treatment phase, the correlational coefficient for green food and weight was 0.519 and red food and weight was 0.029. During the second treatment phase the correlational coefficient for green food and weight was 0.429 and red food and weight was -0.266.

Wendy

Results for Wendy are visually represented through Table 2, Table 5, Figure 2, and Figure 5. Figure 2 shows that her starting weight was 217.4 and her ending weight was 208.6, an 8.8- pound weight loss. Inches in her neck, shoulder, arm, chest, waist, hip, thigh, and calf reduced by 1.4 inches, 2.8 inches, 1.4 inches, 2.01 inches, 4 inches, 5.41 inches, 0.8 inches and 1.59 inches, respectively. This resulted in a total loss of 19.4 inches. Figure 5 shows that Wendy had an overall decrease of red foods and an increase in water consumption. Table 5 shows that during the first treatment phase, the correlational coefficient for green food and weight was 0.16 and red food and weight was -0.327. During the second treatment phase the correlational coefficient for green food and weight was -0.180 and red food and weight was -0.377.

Freja

Results for Freja are visually represented through Table 3, Figure 3 and Figure 6. Figure 3 shows that Freja's starting weight was 148.6 and ending weight was 145, a 3.6-pound weight loss. Freja had an increase in inches in her neck by 0.9 and in her arm by 3.2 inches. Freja decreased inches in her shoulder, chest, waist, hip, thigh, and calf by 6.2, 1.3, 1.3, 0.8, 1.2 and 0.6, respectively. This resulted in an overall reduction in inches of 7.3. Freja increased water

consumption significantly during the study, going from an average of less than 8 oz per day to an average of 50 oz per day. Figure 6 shows that Freja consumed very little red foods but did have an increase in the consumption of green foods. Table 6 shows that during the first treatment phase, the correlational coefficient for green food and weight was 0.52 and red food and weight was 0.02. During the second treatment phase the correlational coefficient for green food and weight was 0.43 and red food and weight was -0.26.

Chapter Summary

Overall, results showed an improvement in health outcomes and a reduction in weight during intervention phases in comparison of baseline and return-to-baseline phases. Each participant had a reduction in weight as well as in overall inches. Additionally, participants increased their average water intake as well as increased the percentage of green foods consumed during treatment. The correlational coefficient for all participants shows a somewhat positive correlation between the consumption of green food and the participant's weight. Conversely, there is a somewhat negative correlation between red food consumption and the participant's weight. These data will be interpreted in the following chapter.

Chapter 5: Summary, Conclusions, and Recommendations

In the following chapter, the results from Chapter 4 will be evaluated. This chapter will provide an interpretation of findings, make recommendations for future studies, and will discuss the significance of the findings of this research.

Interpretation of Findings

This study sought to examine whether behavioral strategies for weight loss would have the same or similar results when implemented virtually rather than when implemented in an in-person environment. In addition, the study posed the following sub-questions:

- Will virtual SBT decrease participants' weight?
- Will virtual SBT affect participants' eating habits?
- Will virtual SBT affect participants' water drinking habits?
- Does SBT implemented in a virtual setting have the same effects on weight loss as SBT in a face-to-face setting?

In considering the primary question, this research did yield similar results to research of SBT that occurs in person. Results of virtual SBT were like results in literature that references in-person SBT for weight loss and improved health outcomes (Pinto et al., 2007). In evaluating the results based on the sub-questions of our study, all participants had a decrease in weight over the course of the seven-week study. Additionally, participants showed an increase in consumption of green foods and a decrease in consumption of red foods. All participants increased water drinking. Most notably, Freja's water drinking behavior tripled during treatment.

The primary purpose of this study was to provide the participants with specific behavior strategies—to broaden their baseline behavioral repertoires—so that they would see an increase in positive health outcomes and a decrease in weight. The strategies of recording foods eaten,

engaging with others via Facebook and Zoom meetings had an overall positive impact on their outcomes.

The correlational coefficients saw some correlation between the types of food consumed and weight, although these data would not be considered statistically significant. They do, however, provide valuable information that could be built upon in future research. These results tell us that consumption of green foods could aid in weight loss whereas consumption of red foods could have a negative impact on weight loss. These data coupled with the overall weight loss data as well as the inches lost provide more support that the recording of specific daily behaviors can lead to a meaningful change over time.

Behavior Chains and Stimulus Control

When discussing the conceptual underpinnings of the results of this study, it is important to keep in mind that many of these behaviors are parts of a behavioral chain. For example, when considering a successful weight loss program, it is not a fast behavioral change; it is a process of small behavior changes linked together overtime to result in positive outcomes. The behavioral components of this study provided participants with a broadened behavioral repertoire that can be chained together to lead to good results. Take the wellness journal for example. The journal had stimulus control over the food recording behavior of the participants. They recorded their food intake, received feedback on their intake during the Zoom meetings and then modified their behavior based on the feedback. Over the course of the study, participants then made small changes like drinking more water or choosing not to eat a candy bar. This chain was reinforced throughout the study, leading to consistent behavior change.

When evaluating the results of the study, it is interesting to see how the daily wellness journal had stimulus control over the behavior of the participants. The presence of the journal

served as the discriminative stimulus to record food consumed. Consider the previously mentioned scenario of Darcy choosing to eat a candy bar. The presence of the journal had stimulus control over her choice to consume the candy bar. Had the journal not been there, she would have eaten the candy bar. Darcy's behavior changed based on the presence of the journal.

Rule-Governed and Contingency-Shaped Behavior

The consideration of rule-governed behavior in this study is quite interesting, as society imposes many rules related to eating behavior and weight loss. There are some rules that could have been established for participants throughout their lifetime that did not meet a consequence that the participant had experienced personally. As an example, a rule that is often discussed when talking about food consumption is the notion of the 'clean plate club'—that a person must finish all a meal before being finished.

Converse to rule-governed behavior, there are multiple instances that demonstrate contingency-shaped behavior, a rule that has been explicitly taught and met a consequence for the specific individual. One such example was the rule to record all food and water consumed accurately. Darcy adhered to this rule so strongly that she chose not to eat a candy bar because she would have to record it. Her candy bar eating behavior decreased so that her food recording behavior would also decrease. Freja, on the other hand, shared during a Zoom meeting that she intentionally mis-recorded water intake, even though the rule was to record accurately. She intentionally mis-reported water intake because she her water intake had previously been punished during a Zoom meeting. She engaged in the behavior of misreporting to avoid future punishment.

Reinforcement/Delayed Reinforcement

As previously mentioned, weight loss is often unsuccessful because people seek out immediate gratification rather than the delayed effects of healthy eating and exercise routines. Unfortunately, weight loss is something that takes time, so it is important to include additional smaller intermittent reinforcers throughout the process to hopefully increase the likelihood that a person will adhere to the plan. Each component of the current study—daily wellness journal, Facebook group and Zoom meetings—reportedly served as a preferred activity, and perhaps a reinforcer, for at least one the participants. Consuming healthy foods was reinforced through feedback provided on the daily wellness journal, in the Facebook group, and/or during the Zoom meetings. Both the Facebook group and the Zoom meetings provided more opportunities for social reinforcement, which can be a key component for some individuals. For example, during one of the Zoom meetings, Freja stated that she would like to drink more water. Darcy suggested that she drink one glass of water before can drink coffee or soda. Freja then increased her water drinking behavior based on this social interaction. Because the Zoom meetings were only help weekly, and participants weren't always able to interact with each other via Facebook, it is conceivable that the daily wellness journal entries provided some more immediate feedback which served as a reinforcer for making healthy food choices daily. Even if they weren't sharing their entries with the other participants, they were recognizing their own progress and positive choices. These smaller instances of reinforcement may have helped to bridge the gap between the more reinforcing social interactions, which, in turn, helped to bridge the delay which is inherent in weight loss.

Punishment

Although not intentional, punishment effects were evident throughout the study. When considering how society has framed weight loss, it is often done within the context of

punishment. Rather than being taught the behaviors to increase—consumption of whole, natural foods, increased volume of water—there is instead a focus on behaviors to decrease—overall consumption of food or specific types of foods. There were some behaviors evident within the study not because they met reinforcement, but because there may have been an established behavioral history of punishment. For example, recording food consumption provided participants an opportunity to evaluate food choices and to decrease the behavior of eating "unhealthy" foods. Darcy reported that, at one point, she considered eating a candy bar, but she knew that she would have to record the candy bar on her daily wellness journal, so she did not consume it. In this anecdote, one behavior – recording the food – served as a punisher of candy bar consumption. Said another way, the requirement of recording food consumption decreased Darcy's eating an unhealthy food item.

Recommendations

This study supported the hypothesis that virtual SBT for improved health outcomes can have the same effect as in-person SBT. There are, however, ways to strengthen this support even further. Literature addressing weight loss often discusses the need for not only evaluation of weight loss strategies, but a greater understanding of weight loss maintenance (Young et al., 2014). Future research could expand this study to include evaluation of the maintenance of weight lost during intervention. Additionally, the duration of the study could be extended to further establish behavior change between baseline and treatment conditions.

Expansion of the sample size and the gender of participants could also provide greater insight into the effect of virtual SBT on weight loss and improved health outcomes. The study could be modified to have a control group and an intervention group, rather than all participants completing the intervention phase. This could provide more opportunities for comparison of

results. The study could also be modified to a multiple baseline design, where each of the components of the study—daily wellness journal, Facebook group and zoom meetings—were staggered across participants to evaluate if one component is more effective than another. Another potential design could include the comparison of consumption of food types with the different intervention components.

This study did not include a quantitative social validity measure, which could have provided greater insight into the participant's interpretation of the study's benefits and limitations. Although a quantitative social validity measure was not used, anecdotal information was provided during the final Zoom meeting with all participants. Interestingly, each participant reported a different component of the study as their preferred behavioral strategy. Wendy reported that she preferred the daily wellness journal tracking over the other two components. She responded to the immediate feedback and reinforcement of healthy behavior that the wellness journal provided. Social reinforcement was not as valuable to Wendy as immediate reinforcement. In addition, the wellness journal provided the opportunity to exercise mindfulness. Rather than rushing through meals, she was present while eating, considering her food choices and experiencing the event of eating rather than eating while working or engaging in another behavior that distracted from the present moment.

Darcy reported that she preferred the interaction in the Facebook group. She engaged in the highest frequency of responding to posts and to comments by other participants. Additionally, she posted outside of the assigned prompts, demonstrating the highest level of engagement with the Facebook page of any of the participants. This tells us that Darcy responds to more frequent social reinforcement, as she interacted with others multiple times per day in the group.

All three participants reported that although they had difficulty finding time to attend zoom meetings, they found the meetings to be of value. Freja specifically shared that she found the most value in the weekly Zoom meetings. She even expressed that she would love to continue the weekly Zoom meetings, as she anecdotally reported that the Zoom meetings had the greatest impact on her behavior.

Because this study included multiple forms of technology, there were some limitations related to its use. The app associated with the scale malfunctioned frequently, causing the researcher to ultimately exclude data that could have been valuable to the results. Additionally, although the tape measure came with instructions, there is a chance for human error in the measuring of body parts. Future research should include IOA data on the participants' demonstration of measurement to confirm that all measurements are as accurate as possible.

The study intentionally focused on categorizing foods as red, yellow and green rather than a caloric total, as the purpose was to isolate the behavioral component of SBT rather than considering the other two components, caloric restriction and physical activity. A caloric total could have changed the behavior of the participants, whereas the focus was the behavioral strategies. An anecdotal review of the daily wellness journals indicated that some participants were likely eating too few calories in a day, which could influence the results. Education around the importance of consuming an estimated number of calories should be included in future research to address this potential limitation.

To participate in this study, participants had to have access to a smart phone and to technology, thus limiting the participation of those who do not have access to a phone. Additionally, all participants live in an area in which a wide variety of foods are readily available, and each had the means to purchase any food desired. The way this study is designed

does not provide those with a lower socioeconomic status the opportunity to participate, although this population is most at-risk for obesity. A modification of the study could include the use of a basic telephone to interact rather than the requirement of access to a smart phone with internet capabilities. Additionally, the information that was provided in the Facebook group could be provided via printouts and could focus on education around foods that are both healthy and cost effective. This would expand the study to be more culturally inclusive. Because sometimes those with a lower socioeconomic receive government assistance, it would be an opportunity to partner with that system to teach people how to maximize their government assisted dollars related to food purchasing.

Implications

The findings of this study support that SBT for weight loss and improved health outcomes is effective when implemented in a virtual setting. It is often difficult for people to find the time to attend live meetings and with the COVID-19 pandemic, large in-person gatherings are often advised against. Additionally, this research provided specific behavior change recommendations to impact health outcomes. Understanding that virtual SBT can be effective in reducing weight and improving health outcomes can assist those who design, operate, and implement these programs to adjust the structure to make them more accessible. Additionally, providing more specific details surrounding the types of behavior interventions used can help provide directive feedback to participants, yielding greater results. These results could be expanded upon to include behavior strategies that are more inclusive of those with a lower socioeconomic status, like phone calls rather than Zoom meetings and printouts to replace information provided via Facebook.

Conclusion

Overweight and obesity are associated with many medical complications that can ultimately lead to increased mortality (Beleigoli et al., 2020). Weight loss is a billion-dollar industry in the United States, yet obesity rates continue to increase. The COVID-19 pandemic has had a negative impact on those with overweight and obesity or those at risk of becoming overweight. This study demonstrated that standard behavior treatment for weight loss, which is comprised of dietary modifications, physical activity, and behavior adjustments, can yield successful outcomes when implemented virtually. When addressing overweight and obesity as well as improved health outcomes, research has supported over and over that there is no quick fix. More importantly, the identification and implementation of behavioral treatment to reach sustainable, incremental outcomes is the best course of action, which this study helps to provide.

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Table 1

Body part measurements across weeks of study for Darcy

Weeks	Neck	Shoulder	Arm	Chest	Waist	Hip	Thigh	Calf
Week 1	13.5	41.4	11.6	39.1	37.1	43.0	16.2	12.2
Week 2	13.0	41.3	11.7	41.3	37.2	40.7	20.3	13.7
Week 3	13.3	44.4	11.8	40.0	36.9	40.5	18.3	13.3
Week 4	10.4	40.9	10.7	38.4	34.9	38.3	15.9	10.4
Week 5	11.2	41.0	10.9	38.7	35.1	38.0	16.1	11.0
Week 6	11.0	40.6	10.5	38.6	35.0	37.5	16.0	11.2
Week 7	11.0	40.1	10.0	39.5	34.2	37.1	16.2	11.0
Reduction	2.5	1.3	1.6	+0.4	2.9	5.9	0.0	1.2

Note: Measurements are in inches

Table 2

Body part measurements across weeks of study for Wendy

Weeks	Neck	Shoulder	Arm	Chest	Waist	Hip	Thigh	Calf
Week 1	16.0	48.2	15.8	41.6	38.0	50.0	27.2	18.3
Week 2	16.0	48.2	15.8	41.6	38.0	50.0	27.2	18.3
Week 3	16.0	48.2	15.8	41.6	38.0	50.0	27.2	18.3
Week 4	15.8	47.4	15.8	41.6	34.5	46.8	27.1	18.3
Week 5	14.9	45.8	14.8	40.2	34.5	44.6	27.1	17.0
Week 6	14.6	45.8	14.8	39.6	34.0	44.6	27.1	16.8
Week 7	14.6	45.4	14.4	39.6	34.0	44.6	26.6	16.8
Reduction	1.4	2.8	1.4	2.0	4.0	5.4	0.6	1.5

Note: Measurements are in inches

Table 3

Body part measurements across weeks of study for Freja

Weeks	Neck	Shoulder	Arm	Chest	Waist	Hip	Thigh	Calf
Week 1	12.7	49.4	10.6	37.0	33.0	42.6	24.8	13.7
Week 2	13.2	49.3	11.4	36.6	33.2	43.3	24.7	13.8
Week 3	13.2	48.4	12.2	37.5	32.3	43.2	24.6	14.6
Week 4	13.5	48.6	12.3	37.5	32.3	43.4	25.3	14.7
Week 5	12.8	47.2	11.2	35.0	33.0	42.5	24.1	15.0
Week 6	12.8	46.1	11.4	36.1	35.0	42.2	23.7	15.0
Week 7	13.6	43.2	13.8	35.7	31.7	41.8	23.6	13.1
Reduction	+0.9	6.2	+3.2	1.3	1.3	0.8	1.2	0.6

Note. Measurements are in inches

Table 4

Correlational coefficient--Darcy

Treatment	Green Food and Weight	Red Food and Weight
Treatment 1	0.30	-0.44
Treatment 2	0.23	-0.51

Note. Comparison between food category and weight.

Table 5

Correlational coefficient--Wendy

Treatment	Green Food and Weight	Red Food and Weight
Treatment 1	0.16	-0.32
Treatment 2	-0.18	-0.37

Note. Comparison between food category and weight.

Table 6

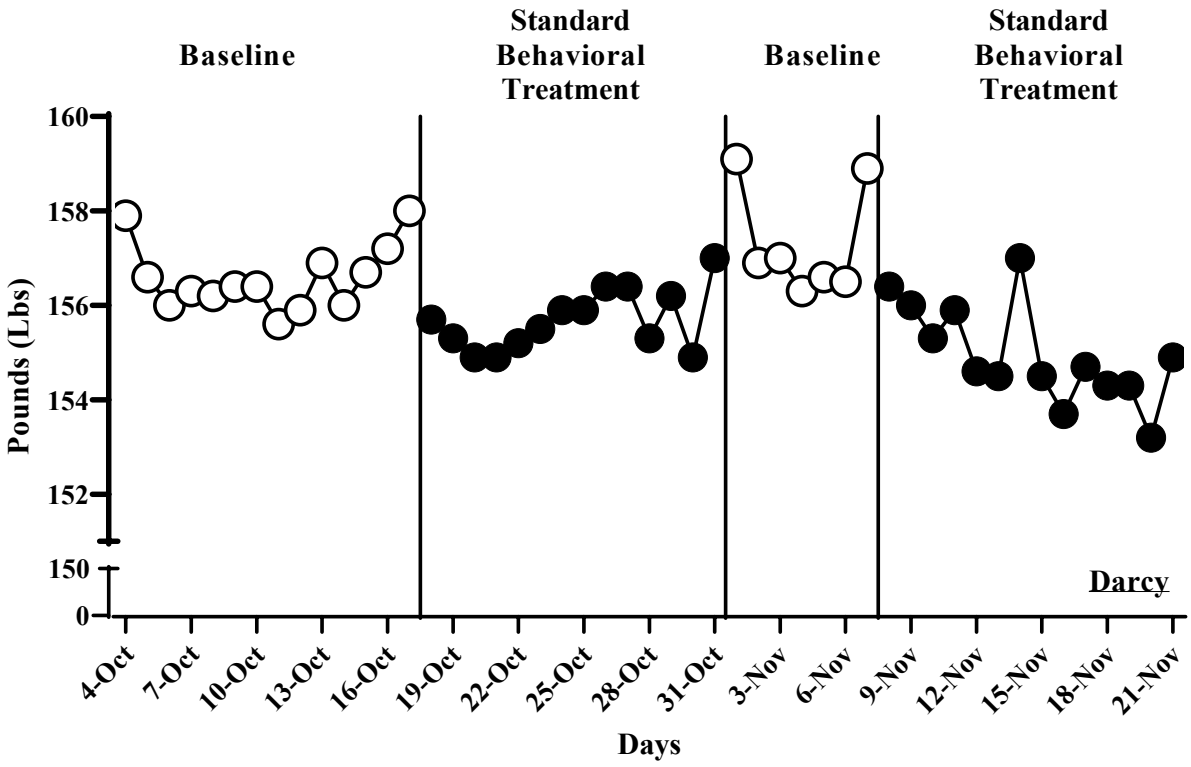
Correlational coefficient--Freja

Treatment	Green Food and Weight	Red Food and Weight
Treatment 1	0.52	0.02
Treatment 2	0.43	-0.26

Note. Comparison between food category and weight.

Figure 1

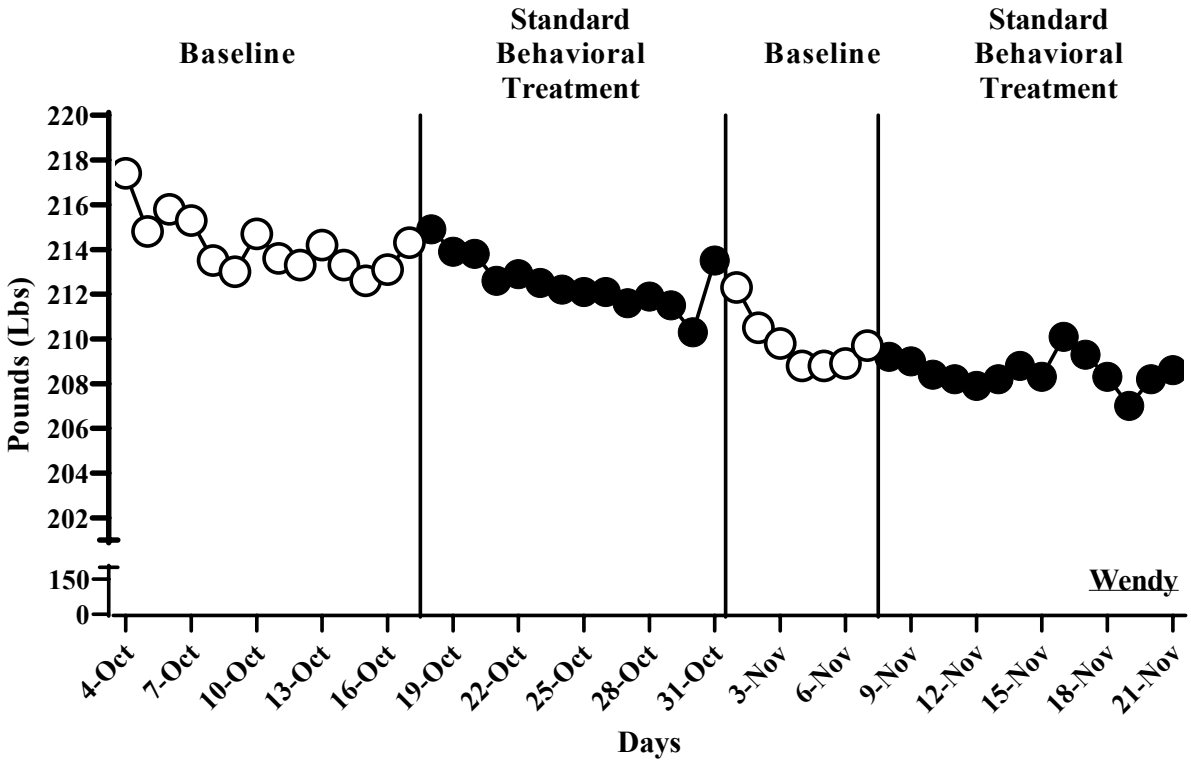
Daily Weight in Pounds



Note. Results for baseline and treatment intervention for Darcy.

Figure 2

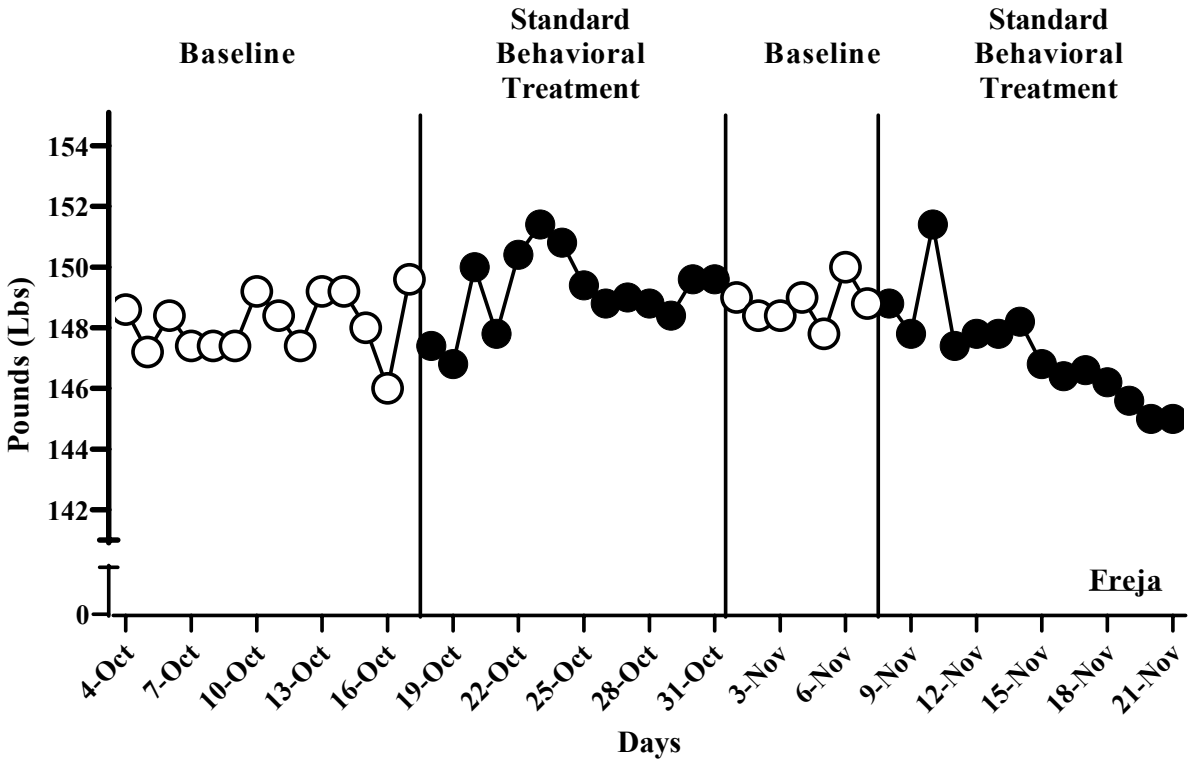
Daily Weight in Pounds



Note. Results of baseline and intervention phases for Wendy.

Figure 3

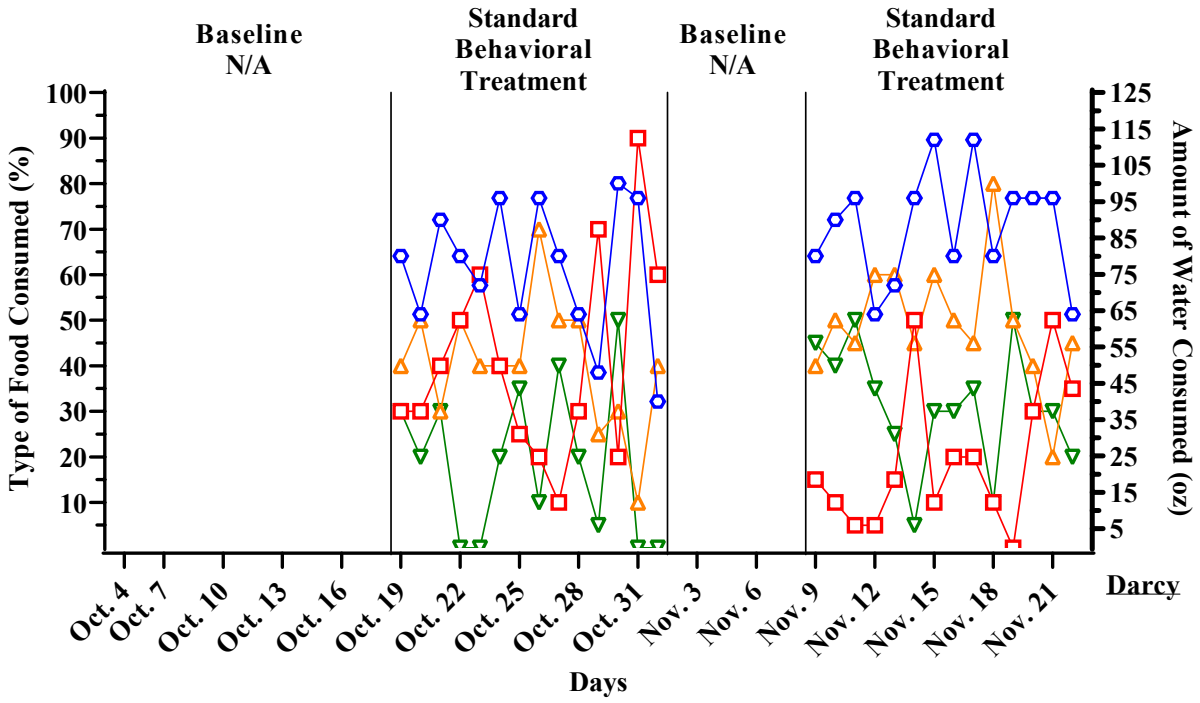
Daily Weight in Pounds



Note. Results of baseline and treatment interventions for Freja.

Figure 4

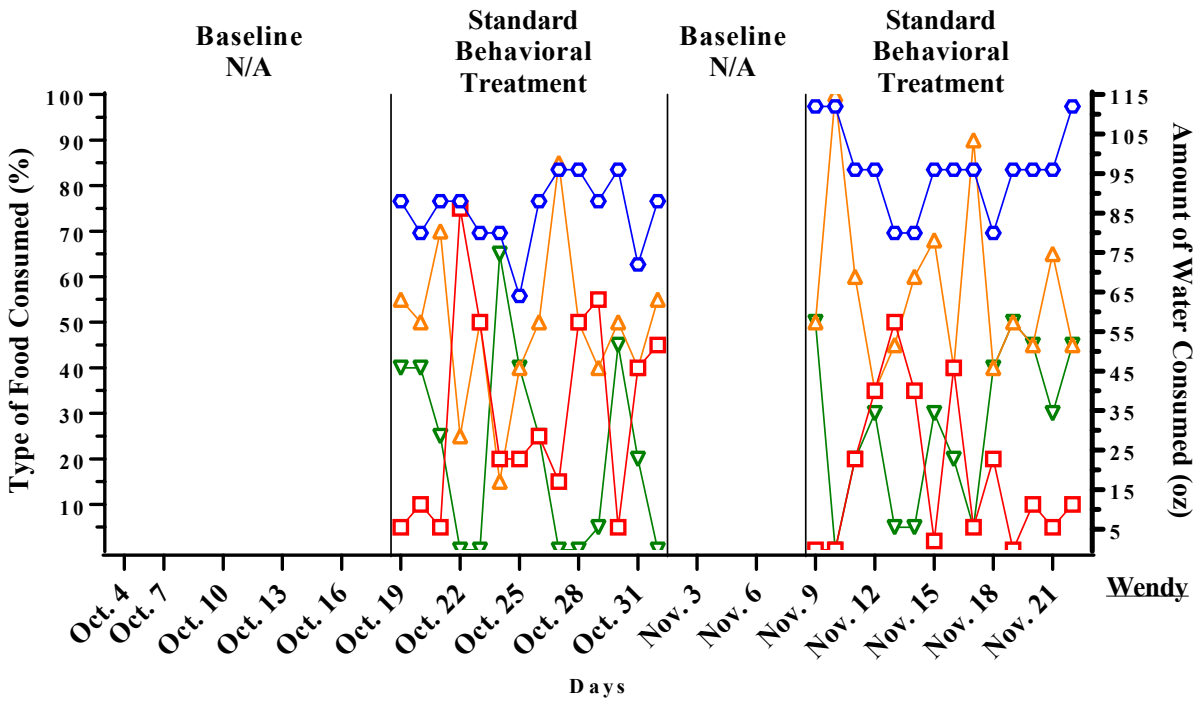
Daily Food and Water Consumption



Note. Results comparing consumption of high (red), moderate (gold), and low-density (green) food and water (blue) consumption for Darcy.

Figure 5

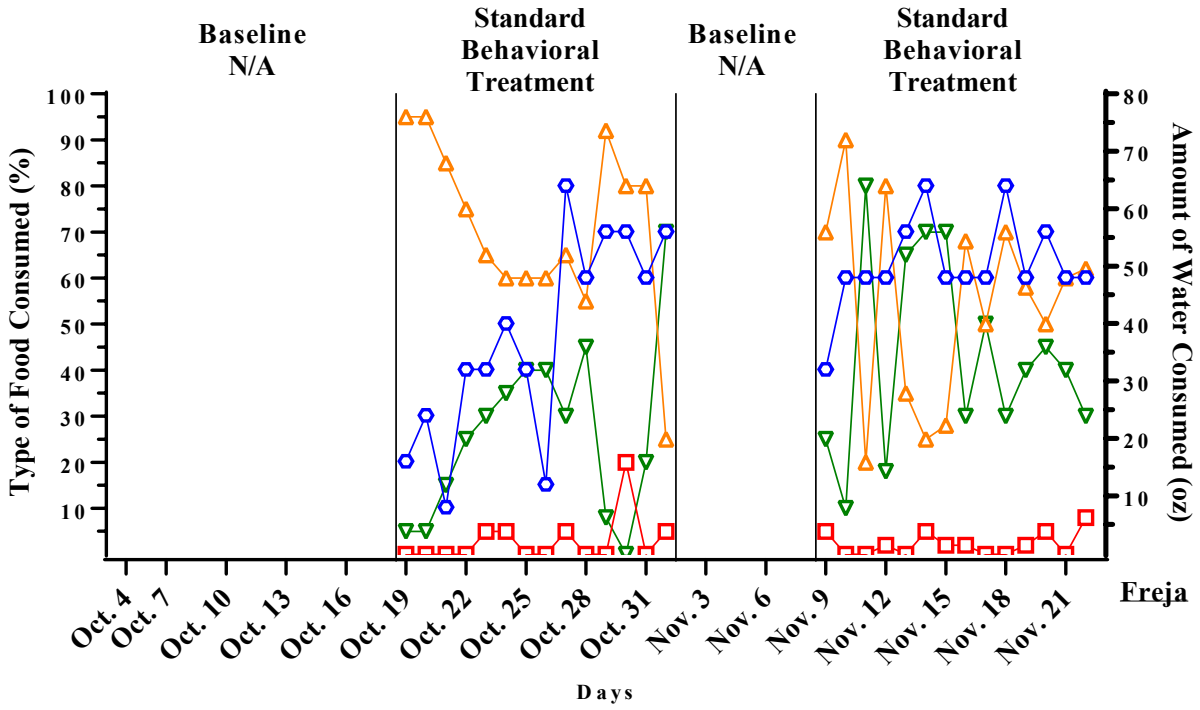
Daily Food and Water Consumption



Note. Results comparing consumption of high (red), moderate (gold), and low-density (green) food and water (blue) consumption Wendy.

Figure 6

Daily Food and Water Consumption



Note. Results comparing consumption of high (red), moderate (gold), and low-density (green) food and water (blue) consumption Freja.

Appendix A: Screening Form

Date: _____

Current weight: _____ pounds

Current height: _____ feet _____ inches

***This information will be used to verify your Body Mass Index.**

Are you interested in losing weight and/or improving overall health outcomes?

YES NO

Please briefly describe your current level of physical activity. Specify how long you can sustain physical activity presently.

_____

_____

_____

_____

_____

Have you participated in a formal weight loss program, overseen by a doctor or nutritionist, in the last 90 days? _____yes _____ no

Do you have access to a smart phone with texting capability? _____yes _____ no

Do you have a medical condition that could impact findings such as pregnancy or previous weight loss surgery? _____yes _____ no

Appendix B : Consent Form

Informed Consent

Investigators: Kristin McCoy, Dr. Julie Ackerlund-Brandt

Study Title: Are you unhealthy? Let's Fix it. The Use of virtual standard behavioral treatment to improve health outcomes.

I am a student at The Chicago School of Professional Psychology. This study is being conducted as a part of my independent study requirement for the Ph.D. in Applied Behavior Analysis.

I am asking you to participate in a research study about standard behavioral treatment and improved health outcomes. You will be asked to complete daily weigh-ins on a scale provided to you and weekly body measurements with a digital tape measure provided to you. Additionally, you will be asked to record all food intake and physical activity, to participate in a Facebook group with other study participants and attend a weekly Zoom meeting. Total time commitment will be approximately 2 hours each week. Although you may not benefit, it will help to understand the efficacy of virtual weight loss treatment. Potential risks of participation include 1) Discomfort during question answering as some questions in the study may ask personal information. 2) Discomfort due to disclosure of health and wellness behaviors. 3) Loss of confidentiality. Please take your time to read the entire document and feel free to ask any questions before signing this document.

Purpose: The primary purpose of this study is to evaluate how virtual participation in standard behavioral treatment impacts weight loss and overall health outcomes. This can help inform practitioners in the future of the most effective and efficient ways to implement weight loss treatment.

Procedures:

Each day, you will weigh yourself using the I-Doo digital smart scale and send a screenshot of the data to the researcher. Once a week, you will measure your hips, thighs, waist and arms with the Jane Choi Digital Smart Tape. You will not be asked to make any other changes to your daily routine.

When told by me, you will begin recording your daily food intake, daily water intake, daily physical activity and overall mood each day. You will send this to me at the end of each week.

You will participate daily in a Facebook group where you will be provided with prompts daily that will require a response. An example of this is “Did you know you should shoot for consuming half your body weight in water each day? Drink a glass when you read this and respond ‘done’ in the comments”.

One time per week, you will attend a 30-minute zoom session where you will participate in a live discussion where you will respond to questions such as “how many days this week did

you reach your water goal?”. Because you will interact with other participants via zoom and facebook, you will be asked to keep the information of other participants confidential.

When the study is over, you will complete a social validity questionnaire about your experience with the study. You will not need to return the scale or tape measure but can keep them.

Risks to Participants: Risks include 1) Discomfort during question answering as some questions in the study may ask personal information. 2) Discomfort due to disclosure of health and wellness behaviors. 3) Loss of confidentiality. Steps to minimize risk include ensuring confidentiality by removing all personal identifiers and replacing them with a number when reporting data. If you feel uncomfortable and wish to stop at any point, you may terminate participation by emailing the me at kmccoy@ego.thechicagoschool.edu.

Benefits to Participants: Although you may not benefit, your participation will help to understand the effects of virtual standard behavior treatment for weight loss.

Alternatives to Participation: Participation in this study is voluntary. You may withdraw from study participation at any time without any penalty.

Confidentiality: During this study, information will be collected about you for the purpose of this research. This includes name, phone number, address, email address, age, gender, height, weight, daily eating habits, medical information including diagnoses and medications.

All completed questionnaires will be kept in a locked file in my personal office for 5 years. They will only be accessible to me and my academic advisor. During this study, only me and the advisor will have access to electronically stored files via secure password. Identifying information will be removed and unique participant identifiers created such that anonymous and confidential data will be utilized for all resulting presentations and publications. Questionnaires sent via the internet will not require any identifying information or record participants email or IP address.

It is possible that your data may be used for future research or distributed to another researcher without your consent. However, information that could identify you will be removed.

Your research records may be reviewed by federal agencies whose responsibility is to protect human subjects participating in research, including the Office of Human Research Protections (OHRP) and by representatives from The Chicago School of Professional Psychology Institutional Review Board, a committee that oversees research.

Questions/Concerns: If you have questions related to the procedures described in this document please contact Kristin McCoy at kmccoy@ego.thechicagoschool.edu

Dr. Julie Ackerlund-Brandt at jbrandt@thechicagoschool.edu

If you have questions concerning your rights in this research study you may contact the Institutional Review Board (IRB), which is concerned with the protection of subjects in research project. You may reach the IRB office Monday-Friday by calling 312.467.2335 or writing:

Institutional Review Board, The Chicago School of Professional Psychology, 325 N. Wells, Chicago, Illinois, 60654.

Consent to Participate in Research

I have read the above information and have received satisfactory answers to my questions. I understand the research project and the procedures involved have been explained to me. I give permission to participate in this research project. My participation is voluntary and I do not have to sign this form if I do not wish to be part of this research project.

I will receive a copy of this consent form for my records.

_____

Name of Participant (print)

_____

Signature of Participant

Date: _____

_____

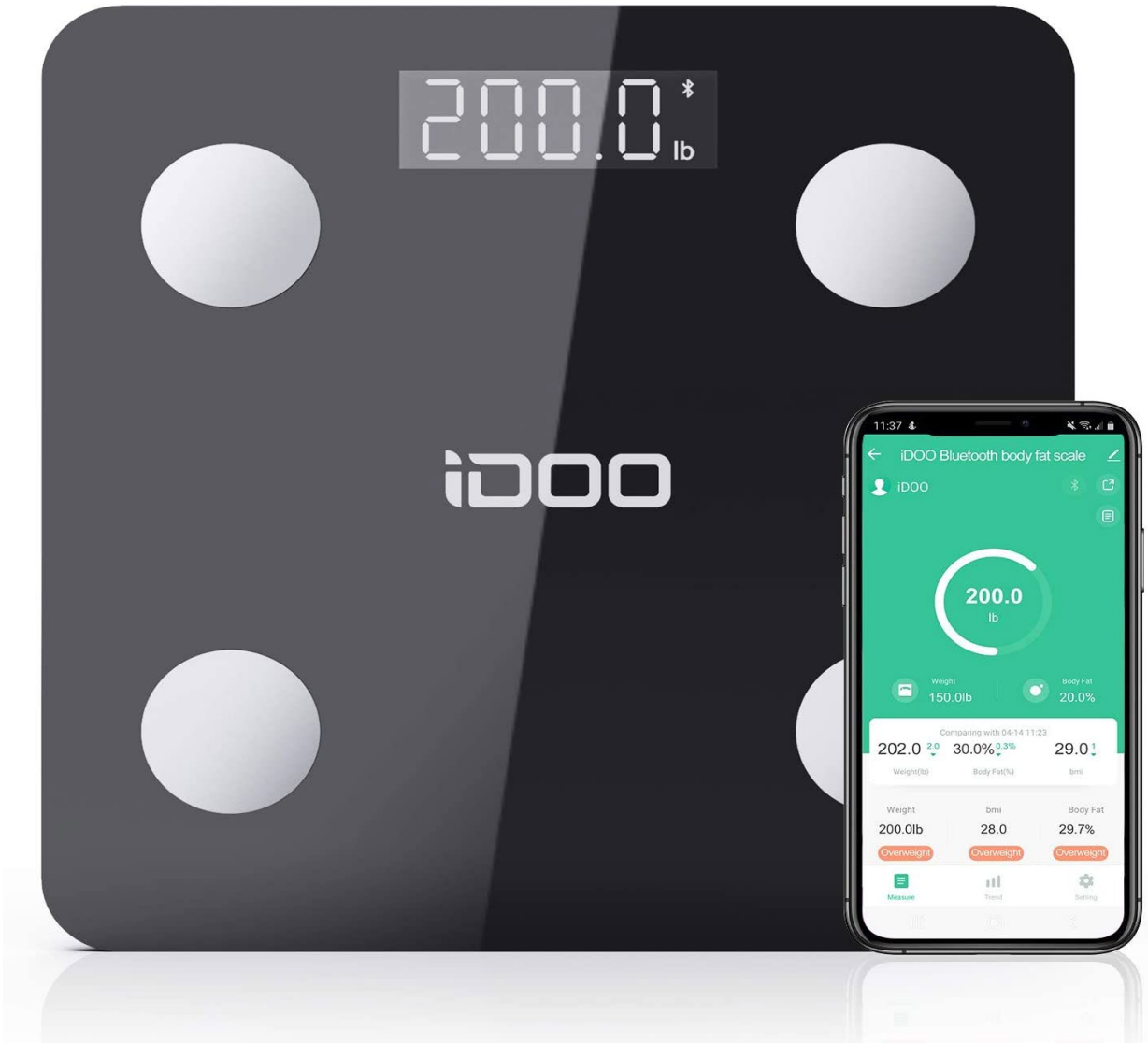
Name of the Person Obtaining Consent (print)

_____

Signature of the Person Obtaining Consent

Date: _____

Appendix C: Scale And Application

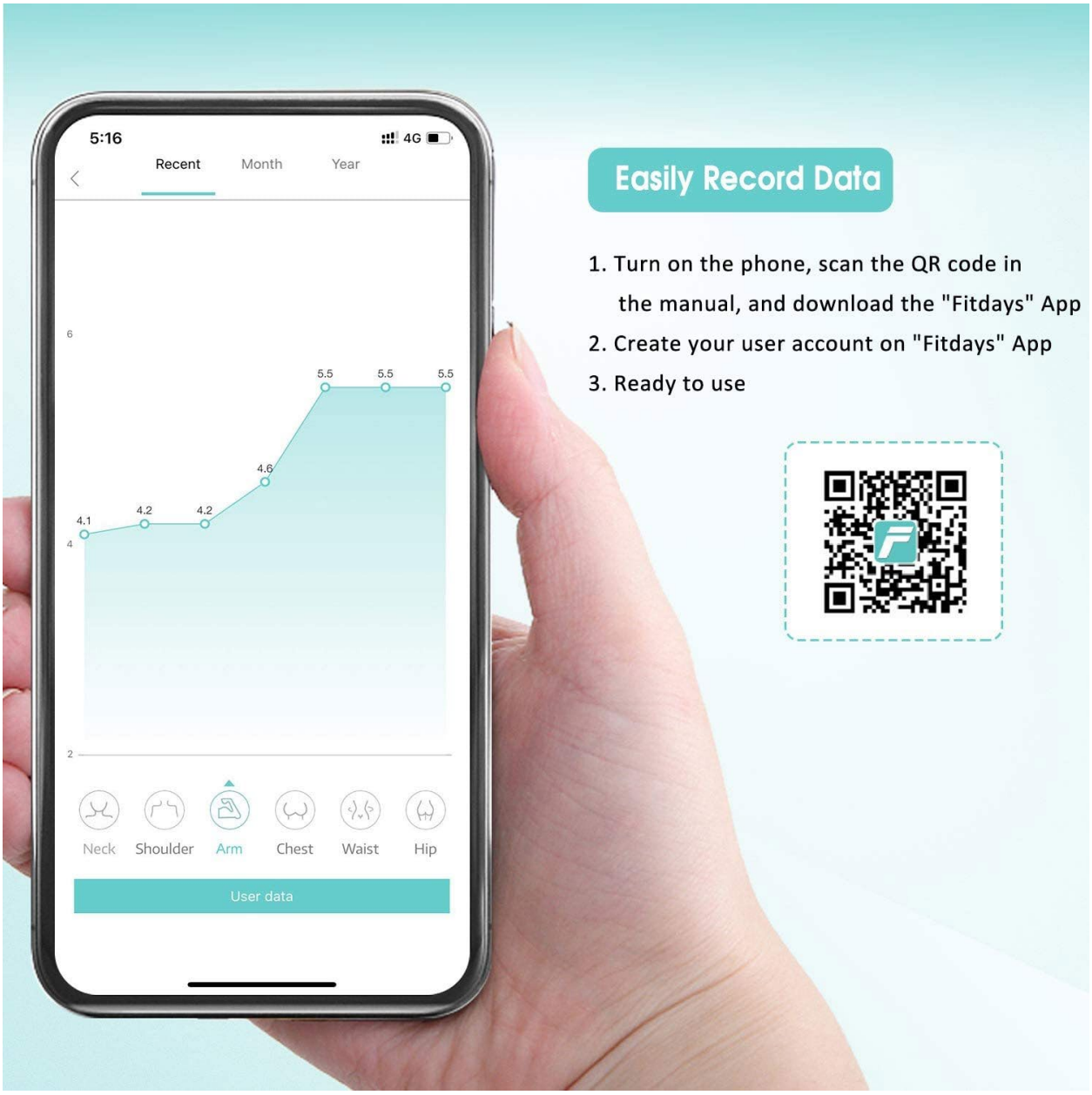



13 Essential Measurements
More than just weight.13 insightful measurements give you an inside look into your body's health
Visceral Fat
Weight
Body shape
Body Fat%
BMI
Body Water%
Bone Mass
Muscle Mass
Body Score
Fat-free Mass
Protein
Basal metabolism
Body Age


Free Gennec App
5 second for registration
2 second for connection
1 second for data analysis
iDOO Bluetooth body fat scale
iDOO
200.0
lb
150.0lb
20.0%
202.0
30.0%
29.0
200.0lb
29.7%
Overweight

Appendix D: Body Measurement Tape and App


Capture Your Fitness Body Metric With One Second
Neck
Shoulder
Waist
Thigh
Arm
Chest
Hip
Calf


5:16
4G
Recent
Month
Year
6
4
2
4.1
4.2
4.2
4.6
5.5
5.5
5.5
Neck
Shoulder
Arm
Chest
Waist
Hip
User data
Easily Record Data
1. Turn on the phone, scan the QR code in the manual, and download the "Fitdays" App
2. Create your user account on "Fitdays" App
3. Ready to use

Appendix E: Daily Wellness Journal

Daily Wellness Journal **Date_____**

Time of Day	**Food/Liquid Consumed**	**Amount of food (i.e. 1 cup, 1 slice)**

Record the time of day, the food you consumed as well as an estimated amount of food. Each line should include only one food item. If you have multiple food items per meal, list them separately. Be as specific as possible. For example, instead of writing “turkey sandwich”, write “two slices of whole wheat bread, 5 slices deli turkey, one piece of swiss cheese, 1 tbs mustard, one tomato slice”.

How many 8 oz glasses of water have you had?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Place a check mark in the box for each glass of water consumed today

How do you feel today? (i.e. frustrated, proud, tired)

_____

_____

Did you exercise today? ☐ yes ☐ no

If so, what type? (walk, weights, etc.)___ For how long?___ _____

What was your perceived level of exertion? (1 is very light; 5 is as difficult as possible)_____

Appendix F: Instructions

How to use the iDoo Smart Scale and Gennec App

1. On your mobile device, download the Gennec App.
2. Create an account.
3. Ensure Bluetooth is ON on your mobile device.
4. Once you are active in the app, enter your current height and weight information.
5. Prior to weighing yourself, place the scale on a flat surface.
6. Open the Gennec App.
7. Step on the scale wearing undergarments and no socks.
8. The scale should be used first thing in the morning before consuming any food/liquid and after voiding.
9. Remain on the scale until the number stops flashing. This indicates that data have been stored in the app.
10. Take a screen shot of the app data for each day and email it to kmccoy@ego.thechicagoschool.edu.
11. You will repeat these measurements one time per week throughout the duration of the study.

**BEFORE you get on the scale, open the app. This seems to be the best way to ensure that the data records.

How to use the Jane Choi Smart Tape and FitDays App

1. On your mobile device, download the FitDays App.
2. Create an account.
3. Ensure Bluetooth is ON on your mobile device.
4. Once you are active in the app, choose “smart tape” under ‘device’.
5. Follow the prompts on the screen for measuring body parts.
6. When measuring, ensure that you have the tape measure taut against the skin.
7. Measurements should be taken on bare skin vs. over clothing.
8. Once you have measured all specified body parts, screenshot the app data and email it to kmccoy@ego.thechicagoschool.edu.
9. You will repeat these measurements one time per week throughout the duration of the study.