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## FIT CAMP A BEHAVIORAL WEIGHT LOSS PROGRAM THE EFFECTS OF SELF-MONITORING, SOCIAL SUPPORT, ATTENDANCE, AND MOTIVATION

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## ABSTRACT OF THESIS

### FIT CAMP A BEHAVIORAL WEIGHT LOSS PROGRAM THE EFFECTS OF SELF-MONITORING, SOCIAL SUPPORT, ATTENDANCE, AND MOTIVATION

Almost half of Americans between 17 and 24 years of age are enrolled in higher education. College is an important life transition period when many young adults establish independence and adopt lasting behavior patterns, especially with regard to diet and physical activity. The first years of college are often associated with weight gain therefore making weight loss and weight gain prevention interventions necessary in this population. Behavioral weight loss programs (BWLP) have shown to be effective in adults, however, to our knowledge, there have been no reports of BWLP focused solely on college-aged young adults. This study compared a 10-week online behavioral weight loss program to a 10-week face-to-face program on the main outcomes of weight loss, change in body fat percentage, and change in physical activity among college students. Correlates of weight loss including self-monitoring, social support, attendance, self-efficacy, and motivation were also examined. Results showed motivation decreased over time, motivation was positively correlated with weight loss, and self-efficacy increased over time.

KEY WORDS: Obesity, self-monitoring, internet, behavior change, weight loss

Erin Marie Murnan

November 6, 2009

FIT CAMP  
A BEHAVIORAL WEIGHT LOSS PROGRAM  
THE EFFECTS OF SELF-MONITORING, SOCIAL SUPPORT, ATTENDANCE, AND  
MOTIVATION

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THESIS

Erin Marie Murnan

The Graduate School  
University of Kentucky

2009

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A BEHAVIORAL WEIGHTLOSS PROGRAM  
THE EFFECTS OF SELF-MONITORING, SOCIAL SUPPORT, ATTENDANCE, AND  
MOTIVATION

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THESIS

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A thesis submitted in partial fulfillment of the  
requirements for the degree of Master of Sciences  
College of Agriculture  
at the University of Kentucky

By

Erin Marie Murnan

Lexington, KY

Director: Dr. Kelly Webber, PhD, MPH, RD, LD, Assistant Professor

Lexington, Kentucky

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## **Chapter 1: Introduction**

Over the past thirty years the rate of overweight and obesity has increased dramatically (Nelson & Story, 2009; Nelson et al., 2007). Overweight and obesity are defined by body mass index (BMI) which is body weight in kilograms divided by height in meters squared (Hoffman et al., 2006; Wharton et al., 2008). A BMI  $\geq 25$  is considered overweight and a BMI of  $\geq 30$  is considered obese (Gold et al., 2007; Hoffman et al., 2006; Huang et al., 2003; Hunter et al., 2008; Peterson et al., 2008). In 2004, 66.3% of United States adults were overweight and 32.2% were obese (Wharton et al., 2008). Between 1976 and 2002, the percentage of overweight or obese 12-19 year olds more than tripled from 5% to 17% (Wharton et al., 2008; Desai et al., 2008). The largest increases in the prevalence of obesity between 1991 and 1998 were among young adults 18-29 years old (Huang, et al., 2003; Racette et al., 2005; Strong, K.A. et al., 2008), having risen from 7.1% in 1991 to 12.1% in 1998 (Mokdad et al., 1999). Results from the National Longitudinal Study of Adolescent Health found obesity to be highly predictive of adulthood obesity (Gordon-Larsen et al., 2004).

Almost half of Americans between 17 and 24 years of age are enrolled in higher education (Nelson et al., 2008). College is an important life transition period when many young adults establish independence and adopt lasting behavior patterns, especially with regard to diet, physical activity, and other lifestyle habits (Buckworth & Nigg, 2004; Desai et al., 2008; Nelson et al., 2008; Wharton et al., 2008). The first years of college are often associated with weight gain (Hivert et al., 2007). Nearly 70% of young adults gain weight in their first two years of college (Nelson et al., 2008). On average, college students gain 1.5 pounds to 7.26 pounds during the first terms or first year of college

(Hivert et al., 2007; Cluskey et al., 2009; Nelson et al., 2008). Therefore, weight loss and weight gain prevention interventions with this group are needed.

Overweight and obesity are associated with increased risk of cardiovascular disease, type 2 diabetes, hypertension, metabolic syndrome, stroke, and colon, renal, esophageal, breast and endometrial cancers (Gold et al., 2007; Winett et al., 2005). Consequently, the diseases associated with overweight and obesity place a major burden on the health care system and the economy, costing the U.S. \$117 billion annually (Gold et al., 2007; Nelson et al., 2008). The increased burden of disease and medical costs due to overweight and obesity indicate a need for programs and interventions that assist with weight loss and maintenance.

Behavioral weight loss programs (BWLP) have been shown to be effective in adults. BWLP with adults have been shown to produce weight losses of 8 to 10% or 9 to 10kg of baseline body weight within 16-26 weeks (Gold et al., 2007; Harvey-Berino et al., 2004; Polzien et al., 2007). BWLP teach cognitive behavioral strategies for weight loss. Strategies include self-monitoring of food intake and physical activity, goal setting, problem solving, and identification of high risk situations (Carels, et al., 2006; Warziski et al., 2008). These strategies are designed to educate participants about the connection between thoughts and behavior (Kalodner & DeLucia, 1990). While few BWLP have been reported in the literature, it is likely that these programs would also be effective with college-age young adults.

## **Chapter 2: Literature Review**

### *The College Environment*

The transition from home to college may be one of the most dramatic environmental changes in a college freshman's life (Levitsky et al., 2004). Not only do students experience leaving home, increased autonomy, changes in social support, and structure, they also experience changes in dietary habits and physical activity habits. Many lifelong health behaviors are established during the college years making it a critical time to develop healthy behaviors (Buckworth & Nigg, 2004; Wharton et al., 2008).

### *Changes in Dietary Consumption*

The college environment may influence health behaviors among college students. For instance, the college environment may contribute to the overconsumption of readily available high calorie foods, especially for students who live on campus and must purchase a meal plan (Kasperek et al., 2008; Strong et al., 2008). Many campus cafeterias serve daily all-you-can-eat buffet style meals which can lead to excess caloric intake.

A study by Levitsky and colleagues (2004) examined changes in body weight among freshman in their first semester of college at Cornell University. They also explored possible contributing factors to weight gain in this population. Of the initial 68 participants, 60 completed the follow up at twelve weeks. Baseline questionnaires asked about students' lifestyles in high school. The follow up questionnaire obtained information on eating, sleeping, and physical activity habits from students' first completed semester. Students were weighed at baseline and at follow up using a Healthometer scale. After twelve weeks freshman gained an average of 4.2 pounds. The

expected annual weight gain among U.S. adults is roughly 0.8 pounds. Freshman involved in this study gained weight at a rate of 11 times greater than the average U.S. adult (Kasperek et al., 2008). Results from this study showed predictors of weight gain to include: increased consumption of high fat foods, increased snacking at night, and eating meals in the all-you-can-eat buffet style dining hall. While a change in sleep habits did affect students eating habits in this study, it was not significant in predicting weight gain. However, a decrease in physical activity was positively correlated with weight gain.

#### *Decreased Consumption of Fruits and Vegetables*

In addition to overconsumption of energy dense foods, several studies have shown decreased consumption of fruits and vegetables among college students (Cluskey & Grobe, 2009; Huang et al., 2003; Kasperek et al., 2008; Racette et al., 2005). According to the 2008 National College Health Assessment, only 10% of college students are consuming the recommended five servings of fruit and vegetables per day. A study conducted with 204 freshman students at Washington University in St. Louis, MO. examined changes in body weight and BMI from the beginning of freshman year to the end of senior year (Racette et al., 2008). Participants were weighed on a balance scale, measured with a stadiometer, and BMIs were calculated at the beginning of fall, and again in spring semester of senior year. Participants completed questionnaires on demographics, exercise, and diet. The diet questionnaire assessed whether students consumed at least the recommended five servings of fruits and vegetables daily, and limited fried food consumption and high-fat fast foods to a maximum of two times during the previous week. Results showed a significant increase in body weight and BMI. As freshman, 15% of participants were overweight or obese. By end of senior

year, 23% of participants were overweight or obese. Less than 30% of freshman participants consumed the recommended five servings of fruits and vegetables. Half of the participants consumed high-fat fast foods and fried foods at least twice during the previous week. Once participants were seniors, 71% continued to consume less than five servings of fruits and vegetables daily.

These results were similar to what Huang and colleagues (2003) found from a study conducted with 736 students ages 18-27 at the University of Kansas. The Berkeley fruit, vegetable, and fiber screener was used to assess diet. This survey included ten items which measured the frequency of consumption of fruit, fruit juice, vegetable juice, potatoes (not including fried potatoes), salad, vegetable soups, cooked vegetables, fiber cereals, beans and bread. These results showed almost 70% of participants did not consume five servings of fruits and vegetables per day (Huang et al., 2003).

A study by Demory-Luce and colleagues (2004) examined changes in food consumption patterns from childhood to young adulthood. Twenty-four hour diet recalls were obtained from young adults aged 19-28 who participated in the Bogalusa Heart Study when they were 10 years old. Results indicated a decrease in diet quality from childhood to young adulthood. At ten years of age, the consumption of fruit and fruit juice was significantly higher than it was at young adulthood. Likewise, vegetable consumption was significantly higher at age 10 than at young adulthood. The overall decrease in diet quality from childhood to young adult indicates a need for intervention during childhood continuing through young adulthood.

Little research is available on the relationship between fruit and vegetable consumption and weight change among college students. However, a study of overweight middle aged adults found that an increase in fruits and vegetables was associated with greater weight loss. In fact, the authors found that an increase of 100 grams of fruit was associated with a decrease of 300 grams of body weight. Similarly, each increase of 100 grams of vegetables was associated with a decrease of 500 grams of body weight after 6 months (Sartorelli et al, 2008).

#### *Decreased Physical Activity*

Not only do college students fail to meet fruit and vegetable recommendations, many fail to meet physical activity recommendations (Buckworth & Nigg, 2004; Cluskey & Grobe, 2009; Economos et al., 2008; Racette et al., 2005). According to the U.S. Department of Health and Human Services and the Center for Disease Control and Prevention (CDC), it is recommended adults ages 18-64 get at least 150 minutes per week of moderate intensity exercise such as brisk walking or 75 minutes of vigorous activity such as jogging or running per week, or a combination of moderate and vigorous activity. In addition, it is recommended that muscle strength training be done at least two days per week. Previous research has shown the largest decline in physical activity occurs between the ages of 15-18 followed by a continuous decline between ages 18-29 (Casperson et al., 2000; Ebben & Brudzynski, 2008; Racette et al., 2005). The decline in physical activity during adolescence leads to a disturbing 70% of American adults who are sedentary or inactive (Buckworth & Nigg, 2004).

### *Justification for College Interventions*

Existing literature has documented the presence of overweight and obesity in young adults, however, few studies have examined methods that may help prevent weight gain or promote weight loss. Studying health behaviors among college students may help identify possible causes of weight gain and assist in the development of weight maintenance and weight loss interventions.

A study conducted by Matvienko and colleagues (2001) examined weight gain prevention in female college freshman by means of education. The intervention consisted of a semester long nutrition science course which emphasized physiology, metabolism, and nutrient use. Twenty-one female freshmen were in the college course and nineteen were in the control group. Upon completion of the intervention, those in the college course group reported less calorie consumption than at baseline whereas those in the control group reported higher calorie consumption than at baseline. The participants who took the course maintained their body weight while those who were in the control group gained weight. These results suggest nutritional education classes may play an important role in the prevention of college freshman weight gain.

### *Behavioral Weight Loss Programs*

The detrimental effects of overweight and obesity on individuals and society make developing successful weight loss programs critical. It is known that just a 5-15% loss of body weight can reduce overweight and obesity related health problems (Saperstein et al., 2007; Shay et al., 2009). Currently, the most effective treatment for overweight and obese adults is a structured, facilitated, face-to-face behavioral weight loss program (Gold et al., 2007; Krukowski et al., 2008; Polzien et al., 2007). Such programs use self-



monitoring, cognitive restructuring, goal setting, social support, physical activity, stimulus control, problem solving, and a behavioral therapist to provide treatment (Berkel et al., 2005; Gold et al., 2007). However, face-to-face programs can have limited access and availability, high running costs, and high dropout rates (Steele et al., 2007).

### *Internet Behavioral Weight Loss Programs*

The internet has great potential as a cost effective tool for weight loss programs (Berkel et al., 2005; Gold et al., 2007; Harvey-Berino et al., 2004; Hunter et al., 2008). Roughly 63-75% of Americans have internet access and 35-44% reported using the internet for nutrition, health, weight loss, and exercise information (Berkel et al., 2005; Krukowski et al., 2008). College students spend large amounts of time on the internet due to online classes, free internet access through their school, and as a way to communicate (Huang, C., 2008). The high rate of overweight and obesity coupled with the high rate of internet use for weight loss warrants further investigation into developing successful weight management programs for this group.

Internet behavioral weight loss programs offer convenience, active participation, anonymity, confidentiality, twenty-four hour availability, instant interactivity, and widespread access (Krukowski et al., 2008; Saperstein et al., 2007; Steele et al., 2007). Online weight loss programs reduce travel barriers, can promote social support through chat rooms, and may encourage self-monitoring more so than face-to-face programs (Krukowski et al., 2008). Interactive features of internet weight loss programs can increase a person's motivation to change their diet and exercise habits and offer encouragement and helpful strategies for overcoming obstacles (Saperstein et al., 2007).

Several studies have shown interactive feedback to be associated with weight loss in online behavioral weight loss programs. Interactive feedback includes computer automated responses, progress charts, physiological calculators, and human responses via email (Krukowski et al., 2008, Tate et al., 2001, Tate et al., 2006).

The short term effectiveness of human email counseling, computer automated counseling, and no counseling in an online weight loss program were evaluated in a study by Tate and colleagues (2006). One hundred ninety-two participants (162 women, 30 men) were weighed at baseline, 3 months, and 6 months. Participants were randomly assigned to 1 of 3 groups; no counseling (NC), computer-automated feedback (AF), or human email counseling (HC). Participants were between ages 39 to 59 with BMIs between 29.2 and 36.2.

In addition to the website access given to all participants, those in the (HC) group and the (AF) group were given access to an online diary to record weight, calorie intake, and exercise. They also had access to a message board where they could communicate with others in their group. Participants in the HC group received feedback once per week from a counselor and those in the AF group received automated messages. The HC and AF group received a weekly reminder email to complete their food diaries along with weekly behavioral lessons.

One hundred fifty two participants followed up at 3 months and 155 participants followed up at 6 months. It is interesting to note those in the AF group were less likely to attend follow-up assessments. From baseline to 3 months the AF and HC groups lost significantly more weight than the NC group. At 6 months, weight loss was significantly

different among the NC and HC groups while the AF group did not differ significantly from the NC and HC groups. The percent of participants who lost 5% or more of initial body weight at 6 months were 27% in the NC group, 34% in the AF group, and 52% in the HC group.

From baseline to 6 months, all groups showed a significant decrease in caloric intake. Greater use of the public website was associated with weight loss in the NC group, not in the AF or HC groups. Among the AF and HC groups, the HC group submitted more self-monitoring diaries than the AF group. Research has shown self-monitoring to be associated with weight loss (Boutelle & Kirschenbaum, 1998; Kruger et al., 2006; Shay et al., 2009) and this study showed diary submission to be significantly correlated with weight loss in the AF and HC groups.

Similar to Tate and colleagues findings (2001), weekly feedback from a counselor or an automated response produced significant weight loss during the first 3 months. Both types of feedback were more effective during the first three months than the website that did not provide behavioral change feedback. At 6 months, the HC group showed greater weight loss than the NC group. The AF group did not differ significantly from the HC and NC groups.

In a randomized controlled trial, Hunter and colleagues (2008) conducted a six month study to evaluate the effectiveness of a weight management behavioral internet treatment (BIT) program compared to usual care. Participants (222 men, 224 women) were members of the U.S. Air Force (USAF) and were randomized to either the usual care or the BIT.

Usual care consisted of an annual visit with a primary care provider for preventative health including assessment of diet and weight. USAF members were expected to work out with their unit at least three times a week and were tested on an annual basis for fitness, BMI, and waist circumference standards.

In addition to usual care, BIT participants received a face-to-face orientation where they received instructions on how to utilize the internet program. The BIT included dietary, behavioral, and exercise recommendations. Participants were asked to log-in at least five days per week to complete self-monitoring food and exercise journals and to record their weekly weight. Participants received feedback on their diaries and weight information they submitted. Weekly lessons consisted of stress management, behavior modification, and stimulus control. Participants also received motivational interviews via telephone at week 4 and week 8.

When compared to the usual care group, the BIT group had better outcomes with weight loss, waist circumference, body fat, prevention of weight gain, and BMI. Participants in the BIT group lost  $2.9 \pm 9.0$  pounds and those in the usual care group gained  $1.3 \pm 7.5$  pounds. Results showed greater use of the website (BIT group) was associated with greater weight loss over the six month study. Those who used the website at least five times per week lost weight whereas those who logged on less than once per week gained weight. These results support previous studies (Boutelle & Kirschenbaum, 1998; Burke et al., 2005; Fujimoto et al., 1992; Kruger et al., 2006) in that self-monitoring was a strong predictor of weight loss.

A study by Moore and colleagues (2008) examined the effects of an internet based nutrition education program on blood pressure, weight, and eating habits after one year of participation. The DASH for Health program was based on the DASH diet (Dietary Approaches to Stop Hypertension), and was designed to provide minimal personal contact and to improve nutritional and physical activity habits among adults.

The Dash for Health program was offered as a free benefit to employees and their spouses at a company in Massachusetts. Participants were given access to a website and asked to enter their weight, blood pressure, and food recalls. The website calculated the self-entered data into progress graphs for participants. Weekly articles on healthy eating and exercise were posted to the website.

At 12 months, 735 of the original 2834 participants were still using the website. Based on the self entered food recalls, participants were consuming significantly more fruits and vegetables at 12 months than at the beginning of the study. It is interesting to note that carbonated beverage consumption decreased by the end of the study. Participants who were overweight or obese lost an average of 4.2 pounds at 12 months. Those who visited the website more often were more likely to have decreased their blood pressure and weight loss. This study found the DASH for Health program delivered online to be associated with significant weight loss, lowering of blood pressure, and nutritional improvements after one year.

### *Self-monitoring*

Self-monitoring has been used successfully in many types of interventions, including weight loss (Burke et al., 2005). Self-monitoring for weight loss involves

detailed record keeping of caloric intake, time of food intake, self-weighing, mood when eating, and exercise in total minutes. Self-monitoring of caloric intake is associated with less caloric consumption, which leads to weight loss (Shay et al., 2009). Self-monitoring encourages the development of accountability and increases self-awareness as to what foods are being consumed under various circumstances. For instance, through self-monitoring, an individual may learn what time of the day they are most likely to overeat and what moods may influence their food intake (Berkel et al., 2005; Burke et al., 2007; Kruger et al., 2006; Shay et al., 2009).

Several studies have found positive correlations between self-monitoring and weight loss (Boutelle & Kirschenbaum, 1998; Burke et al., 2005; Fujimoto et al., 1992; Shay et al., 2009). A study by Kruger and colleagues (2006) examined differences in reported weight loss strategies and attitudes of participants who reported successful weight loss and those who reported unsuccessful weight loss. Data from the 2004 Styles mail survey were used. Questions were developed by experts from health agencies, including the Centers of Disease Control and Prevention. Among the behaviors examined were self-monitoring, diet modification, and physical activity. Authors found significantly more successful weight losers versus unsuccessful losers reported self-monitoring most days of the week. For instance, 35.9% of successful losers planned meals versus 24.9% of unsuccessful losers planned meals. Nearly 18% of successful weight losers recorded caloric intake whereas only 9% of unsuccessful losers recorded calories. 16.4% of successful losers tracked fat and 15.9% measured food on plates and only 6.6% of unsuccessful losers recorded fat intake and 6.7% measured food on plates. Also noteworthy, 20.3% of successful losers weighed themselves daily whereas only

11.0% of unsuccessful losers weighed daily. Results of this study suggest self-monitoring behaviors such as recording calories and physical activity, and weighing oneself daily may be important for weight loss and weight loss maintenance.

In another study Butryn and colleagues (2007) investigated characteristics associated with consistent self-weighing. Specifically, they examined the relationship between self-weighing and weight loss maintenance. Self-weighing may help individuals notice how food consumption and exercise influences body weight. Participants were members of the National Weight Control Registry (NWCR). The NWCR was created in 1994 by Wing and Hill as a way to study behaviors and characteristics of individuals who have been successful at maintaining weight loss (Shay et al.,). This database was developed to track successful adult weight maintainers who have lost  $\geq 30$  pounds and maintained the loss for at least 1 year (Butryn et al., 2007). Successful weight losers of the NWCR have several similar behavioral characteristics. For example, most members report they eat breakfast every day, exercise regularly, watch 10 or less hours of television per week, and consistently self-monitor their weight.

Of the 3,003 participants, 2,462 (82%) followed up at one year. Results indicated participants who completed follow up at one year versus those who did not were significantly older in age ( $48.7 \pm 12.4$  years vs.  $44.5 \pm 12.7$  years) and had lower BMI ( $25.1 \pm 4.8$  vs.  $26.0 \pm 5.1$ ). The frequency of self-weighing was associated with older age, lower BMI at highest lifetime weight, and lower BMI at baseline. Authors reported those who maintained or increased frequency of self-weighing were associated with less weight regain which suggests self-weighing could be beneficial for weight loss and long term weight maintenance.

A study conducted by Wing and colleagues (2007) found similar results with self-weighing. They investigated psychological effects of daily self-weighing to determine whether daily weighing had negative psychological effects on participants. They did not find any negative effects of daily self-weighing. Instead, they found increased self-weighing to be associated with weight loss, increases in dietary restraint, and decreased disinhibition.

### *Social support*

Like self-monitoring, social support has been shown to be helpful in reaching and maintaining health behavior changes (Verheijden, et al., 2005). Evidence suggests social structure, whether friends, family, co-workers, or support groups provide meaningful support, encourages emotional expression, and helps individuals deal with stress (Marcus & Elkins, 2004). Support groups provide individuals with a sense of connection which can help them adhere to a weight loss program (Zirui Song, et al., 2008).

A study by Krukowski and coworkers (2008), assessed usage patterns of a weight control website and the relationship of website features to weight loss and weight loss maintenance. Participants (102 females, 21 males) took part in this 12 month behavioral weight control program over the Internet. The average age of participants was 46.8 years and the average BMI was 31.7 kg/m<sup>2</sup>. Body weight was measured using a beam balance scale at baseline, 6 months, and 12 months. Height was self-reported at baseline. The number of log-ins and utilization of web features by participants were automatically recorded.



Weight loss treatment consisted of changing eating habits and physical activity by using behavior modification techniques. Lesson topics included stimulus control, goal setting, social support, problem solving, and ways to prevent relapse. Group chat sessions took place weekly during the treatment phase from 0 to 6 months. Monthly maintenance meetings were held during 7 to 12 months. The purpose of the maintenance period was to help participants implement and maintain what they had learned during the treatment phase. Participants reviewed weekly lessons and submitted corresponding assignments to their facilitator before the chat session. The facilitator provided personalized feedback on homework and self-monitoring journals. Participants were encouraged to post comments to the online bulletin boards.

The first six months of the study consisted of the treatment period and the last six months were the maintenance period. At six months, participants lost an average of  $16.5 \pm 14.1$  pounds, or 8.5% of their baseline weight at six months. At twelve months, participants lost an average of  $14.6 \pm 14.6$  pounds, or 7.5% of baseline weight. It is interesting to note that the only significant baseline difference between those who followed up and those who did not were that the non-completers were significantly heavier at baseline than those who completed the program ( $206.8 \pm 48.3$  pounds vs.  $197.8 \pm 27.1$  pounds).

Website utilization was strongly associated with weight loss. The more times a person logged in, the more likely they were to lose weight. During the treatment phase, progress charts, physiological calculators, and past journals were the best predictors of weight loss. During the maintenance period, the best predictor of weight loss was social support, which included online chats, and accessing biological information and email

addresses of other participants. These results suggest visual representations via the internet of goal progression, self-monitoring, feedback, and social support were predictive of weight loss and weight loss maintenance.

### *Attendance*

In addition to self-monitoring and social support, attendance to any type of program can influence outcomes. Previous research has shown poor program attendance to be associated with unsatisfactory program outcomes (Marcus et al., 2000; Orth et al., 2008; Schulz et al., 2008; Steele et al., 2007; Zirui Song et al., 2008). Increased attendance to face-to-face sessions or support groups have shown increased weight loss among participants (Chao et al., 2000; Marcus et al., 2000; Orth et al., 2008; Schulz et al., 2008; Zirui Song et al., 2008). Several internet weight loss studies have also shown increased attendance (website log-ins) associated with greater weight loss (Gold et al., 2007; Steele et al., 2007; Tate et al., 2001).

A 12 week physical activity intervention (“Health-eSteps) conducted by Steele and coworkers (2007) investigated attendance (program exposure) of three program delivery methods. The face-to-face (FACE) group received lesson materials in a traditional face-to-face session for one hour per week. Both the internet-mediated (IM) group and the internet-only (IO) group received the same lesson materials as the FACE group. In addition to the lesson materials delivered online, the IM group received 2 face-to-face sessions. Lessons included topics such as goal setting, physical activity, benefits and barriers, self-talk, social support, self-monitoring, relapse prevention, and time management.

The Health-eSteps intervention attracted 160 women and 32 men. Seventy-five percent program exposures were defined as attending 75% of face-to-face sessions or being exposed to 75% of the information delivered online.

Almost 44% of participants attended or were exposed to at least 75% of the material. The results showed the IO group had higher rates of exposure and were more likely exposed to a minimum of 75% of the program material. These results showed higher attendance to be associated with higher physical activity levels, which is similar to previous studies showing higher attendance rates to be associated with more desirable program outcomes.

A retrospective study by Zirui Song and colleagues (2008) examined the association between support group attendance and weight loss after Roux-en-Y gastric bypass (RYGB). The study consisted of 78 patients who had undergone laparoscopic RYGB over a consecutive two year period. Of the 78 patients, 28 attended > 5 support group meetings and made up group A. The remaining 50 patients attended  $\leq$  5 support meetings and comprised of group B. Postoperative follow-up appointments were scheduled at 2 and 6 weeks, 3, 6, 9, and 12 months, and annually after the first year.

Monthly support group meetings were led by a surgeon, nurse practitioner, and a nutritionist. Meetings were conducted in an open forum format which allowed patients to support one another in a nonthreatening environment. Meetings lasted 1-2 hours and took place on the hospital campus. Patients directed group discussions by bringing up their topics of interest. One important component of the support group meetings was that those who attended were patients in various stages of the weight loss process. Some had

not had the surgery yet, others recently had surgery, and some patients were more than twelve months post op. This was helpful in enabling members to teach and learn from each other throughout the sessions.

There was a significant difference in weight loss between group A and B at 9 and 12 months post op. There were not significant differences in the earlier follow-up appointments. Weight loss was associated with the number of support group meetings attended; patients in group A who attended  $> 5$  meetings had an average of 55.5% excess weight loss at 12 months whereas patients in group B who attended  $\leq 5$  meetings had an average of 47.1% excess weight loss. Results indicate support group attendance may indirectly influence weight loss by offering education, social support, and relationships instead of directly affecting the physiology of losing weight.

### *Self-efficacy*

Self-efficacy is a person's belief in his or her abilities to perform certain behaviors necessary for reaching a goal (Bandura, 1977; Butler & Mellor, 2006; Warziski et al., 2008). The strength of an individual's perceived self-efficacy can be a determining factor of one's actions. A person who has high perceived self-efficacy is more likely to continue efforts to reach a goal than someone with lower self-efficacy (Warziski et al., 2008).

Roach and colleagues (2003) conducted a 12-week weight loss intervention among young adults (ages 18-23) in college to assess the effectiveness of self-efficacy with weight loss. The intervention consisted of 12 weekly sessions and covered various nutrition topics and activities to promote self-efficacy for weight loss. The control group received the same information as the intervention group minus the self-efficacy activities.

Of the 73 participants, 66 completed the program, all of whom were female. The intervention group consisted of 48 participants and the control group 18. The intervention group showed a greater improvement among food choices and greater weight loss than the control group. Self-efficacy was significantly correlated with weight loss among the intervention group, but not with the control group.

Similar results were found in a study by Warziski and coworkers (2008) when they examined whether self-efficacy was associated with weight loss over time. Participants attended weekly sessions for the first 6 months, biweekly for months 7-9, monthly for months 10-12, followed by a 6 month maintenance period. During the maintenance period, participants had no contact with the staff running the study. Sessions focused on self-monitoring, goal settings, physical activity, problem solving, recipe modifications, and feedback on progress and goal attainment.

Results revealed several outcomes. The greatest increase in self-efficacy and the greatest weight loss occurred during the first 6 months of the study. Months 6-12 showed a plateau with weight loss and little change in self-efficacy. During the maintenance period, months 12-18, self-efficacy significantly decreased and significant weight gain occurred.

### *Motivation*

Research has shown the importance of motivated behaviors such as regular exercise, goal setting, weight management, and not smoking to play an important role in the maintenance of health (Butler & Mellor, 2006; Furia et al., 2009; Koestner et al., 2008; Silva et al., 2008). Motivation is the psychological driving force that can

influence a person to reach a goal (Butler & Mellor, 2006; Silva et al., 2008) making it a critical component for weight loss goals.

Self-Determination Theory (SDT) was developed by Deci and Ryan to describe different types of motivation. The SDT suggests two different types of motivation, autonomous and controlled (Silva et al., 2008). Autonomous regulation involves choice. When person's behavior is personally important and congruent to their values, they are said to experience autonomous motivation. Controlled regulation involves feelings of pressure or coercion by an interpersonal force. People are said to experience controlled motivation when they behave because of a threat, reward, or demand from an external agent (Silva et al., 2008; Williams et al., 2002). Autonomously motivated behaviors are more likely to produce long lasting results whereas controlled motivated behaviors usually only last while self-imposed pressure remains in place (Silva et al., 2008).

Williams and colleagues (1996) conducted a 6 month, medically supervised, very low calorie weight loss program with severely obese patients. The authors predicted patients who reported stronger autonomous reasons for participating in the program would attend more weekly group meetings, lose more weight, maintain an exercise program, and have maintained a greater weight loss at a 23 month follow up than those with lower autonomous motivation.

Patients were on a very low calorie liquid diet (Optifast) during the first 13 weeks of the program. Then normal food was slowly reintroduced at limited levels. Patients attended weekly group meetings to encourage peer support, facilitate discussions, and to talk about self-monitoring behaviors. All patients lost weight during the first 13 weeks,

and all patients regained some weight back once they began eating regular foods. Patients who dropped out before the 6 months had lower scores of autonomous motivation than those who completed the full 6 months. Results showed the degree of autonomous motivation predicted attendance at weekly meetings, weight loss throughout the program, and maintenance of weight loss at the 23 month follow up.

Koestner and colleagues (2008) investigated the relationship between autonomous motivation, controlled motivation, and goal progress to demonstrate the importance of autonomous and controlled motivation in accomplishing personal goals. They found autonomous motivation positively correlated with goal progress whereas controlled motivation was not related to goal progress.

A study by Williams and colleagues (2009) applied SDT to predict medication adherence, quality of life, and physiological outcomes in patients with diabetes. A total of 2,038 participants responded to a mixed telephone and mail survey which assessed perceived autonomy support from health care providers, autonomous self-regulation for medication consumption, and perceived competence for diabetes self-care management, medication adherence, and quality of life. The authors found autonomous self-regulation was associated with quality of life and adherence to medication use. Results also suggested health care providers who supported patients' autonomous self-regulation for medication use and perceived competence for diabetes management might have increased patients' quality of life and improved physiological outcomes. These studies suggested participants whose health related behaviors were more autonomous showed better adherence to healthy behavior change.

### **Chapter 3: Research Purpose**

The purpose of this exploratory study was to compare a 10-week online behavioral weight loss program to a 10-week face-to-face behavioral weight loss program on the main outcomes of weight loss, change in body fat percentage, and change in physical activity. Correlates of weight loss were also examined, including self-monitoring, social support, attendance, self-efficacy, and motivation.

#### **Research Hypotheses**

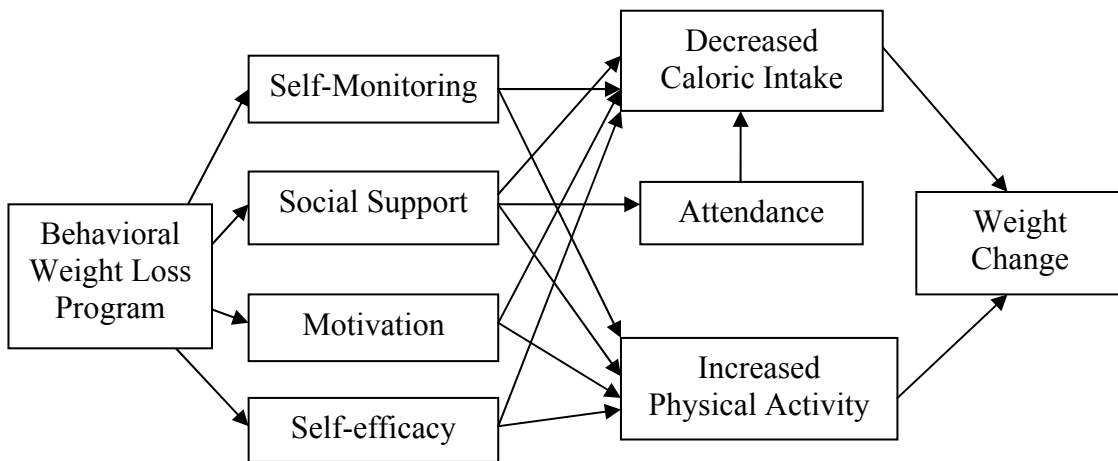
#1: Participants in both groups will experience the following as a result of participating in the 10-week program: weight loss, decrease in waist circumference, decrease in body fat, increase in physical activity level, and an increase in self-efficacy.

#2: Among both groups, weight loss will be positively correlated with attendance, number of self-monitoring journals completed, and level of social support, self-efficacy, and autonomous motivation at baseline.



## Theoretical Framework

There are several determinants of weight loss, including self-monitoring, social support, attendance, motivation, and self-efficacy. This behavioral weight loss study aimed to influence self-monitoring, social support which could influence attendance, motivation and self-efficacy. All of these behaviors would then have an influence on whether or not a participant decreased caloric intake and or increased physical activity, thus resulting in weight change.



## **Chapter 4: Methodology**

### *Participants*

Students were recruited through advertisements placed in the Kentucky Kernel and flyers posted around campus. Interested participants were screened over the telephone to determine eligibility. In order to participate, students had to be between the ages of 18 and 25, have a BMI between 25 and 40, and be interested in losing weight. If participants had lost more than 10 pounds in the past year, they were ineligible. If female participants were breastfeeding, had a child under the age of 9 months, or were planning to become pregnant in the next 4 to 5 months, they were ineligible. Additional exclusions included: taking weight loss medications and conflicts with scheduled meeting times. Participants who completed the follow-up assessment were mailed a check for ten dollars. Institutional Review Board (IRB) approval was obtained from the University of Kentucky prior to the initiation of this study.

### *Procedure*

Eligible participants attended a mandatory orientation which described details of the study. During orientation, participants signed consent forms and completed the following questionnaires: demographic, multidimensional scale of perceived social support (Zimlet, Dahlem, Zimet & Farley, 1988), weight efficacy lifestyle questionnaire (Clark et al., 1991), and a treatment self-regulation questionnaire (Ryan, Plant, & O'Malley, 1995) concerning entering a weight loss program.

Upon completion of the orientation, participants made assessment appointments with graduate research assistants. Assessments consisted of anthropometric measurements such as height in inches as measured with a stadiometer, waist

circumference in centimeters, and weight and fat mass percentage as measured by the Bod Pod. Participants' BMI's were calculated by dividing weight in pounds by height in inches squared then multiplied by 703.

The Bod Pod by Life Measurement Inc. is an air displacement plethysmograph designed to measure fat and fat free mass (body composition) by using whole body densitometry. The Bod Pod provides information on Resting Metabolic Rate (RMR) and Total Energy Expenditure (TEE). This machine provides accurate results in less than 10 minutes.

Research was conducted in the Department of Nutrition and Food Science (NFS) at the University of Kentucky. The NFS BodPod assessment lab was used for recording anthropometric measures at baseline and follow up. All procedures were approved by the University of Kentucky's International Review Board.

#### *Data Collection Measures*

The demographic questionnaire asked participants' date of birth, race/ethnicity, marital status, and whether or not they had children.

The multidimensional scale of perceived social support (MSPSS) developed by Zimet, Dahlem, Zimet, and Farley (1988) consisted of 12 questions and answers are on a scale of 1 to 7, with 1 being "very strongly disagree" and 7 being "very strongly agree." This questionnaire provided information as to the participants' perception of support from family, friends, and significant others. The MSPSS score can range from 12 to 84.

The Treatment Self-regulation Questionnaire (TSRQ) developed by Ryan, Plant, and O'Malley (1995) provided information on participants' motivation. The TSRQ for

this study consisted of four groups of questions. Answers were based on a scale from 1 to 7 with 1 being “not at all true” and 7 being very true. The purpose of this questionnaire was to examine participants autonomous and controlled motivation concerning entering the weight loss program (baseline) and continuing program participation (follow-up). All answers are averaged making the score range 1 to 7.

The Weight Efficacy Lifestyle Questionnaire (WEL-Q) was developed by Clark and colleagues (1991) to assess self-efficacy, or confidence in a person’s ability to resist eating in various situations (Kim et al., 2008). The WEL-Q consists of 20 statements where participants answer on a scale from 0 (not confident) to 9 (very confident). The WEL-Q score can range between 0 and 180.

The “Physical Activity and You” questionnaire was developed by Marcus and colleagues (1992) and provided information on participants’ confidence to exercise in different situations. This questionnaire contained 5 questions and could be answered on a scale of 1-5, with 1 being not at all confident and 5 being extremely confident. The score range for the Physical Activity and You questionnaire can range between 5 and 25.

The Physical Activity questionnaire, developed for the Women’s Health Initiative (WHI) Observational study in 1992 was designed to assess patterns of physical activity based on how often and how long a participant spent on an activity (Meyer et al., 2009). This questionnaire asked participants how often and the duration of walking, strenuous exercise, moderate exercise, and mild exercise.

## **Statistical Analyses**

Data were analyzed using Windows version 16.0 of the Statistical Package for the Social Sciences (SPSS, Chicago, IL). Frequency statistics were used to examine race and marital status. Descriptive statistics were used to evaluate age, attendance, and number of self-monitoring journals completed. Paired sample t-tests were used to compare baseline and follow-up assessments. Correlational statistics were used to analyze attendance and weight loss, attendance and change in physical activity, change in physical activity and weight loss, change in autonomous motivation and weight loss, and change in WEL-Q and weight loss.

## **Chapter 5: Results**

A total of fifteen students met eligibility requirements and followed through with the initial assessment. Seven of the fifteen students were placed in the face-to-face group and eight were placed in the online group. Only four participants from the face-to-face group and two from the online group completed final assessments. Of the final 6 participants, 66.7% were Caucasian, 33.3% were African American, 66.7% were single, and 33.3% were living with a partner.

Participants (5 females, 1 male) were a mean age of 20.7 years, attended an average of 4 out of 10 sessions, and completed an average of 1 self-monitoring diary during the 10 week study. One participant completed 5 food diaries, one completed 3, and 4 did not complete any food diaries.

Although the sample size was too small to run statistics between the face-to-face group and the online group, attendance rates were higher among the face-to-face group and only one participant from the face-to-face group completed 3 food journals and one participant from the online group completed 5 food journals.

Table 5.1 shows age, race, and baseline descriptive statistics.

**Table 5.1: Overall Baseline Descriptive Statistics**

(N=6)	Standard Mean $\pm$ SD
<b>Age</b>	20.7 $\pm$ 2.1
<b>Race</b>	66.7% Caucasian 33.3% African American
<b>Weight (kg)</b>	87.8 $\pm$ 13.9
<b>Waist Circumference (cm)</b>	99.3 $\pm$ 13.8
<b>BMI (kg/m<sup>2</sup>)</b>	33.0 $\pm$ 5.7
<b>Percentage Fat Mass</b>	38.5 $\pm$ 9.5
<b>Weight loss Self-efficacy (WEL-Q)</b>	113.2 $\pm$ 27.2
<b>Physical Activity Self-efficacy</b>	10.0 $\pm$ 4.0
<b>Autonomous Motivation (TSRQ)</b>	6.2 $\pm$ .52
<b>Controlled Motivation (TSRQ)</b>	3.9 $\pm$ .95
<b>Social Support</b>	72.4 $\pm$ 6.8
<b>Physical Activity (kcal/week)</b>	1465.0 $\pm$ 875.1

Table 5.2 shows the mean outcome measures from baseline to the 10 week follow up. Although not significant, there was a decrease in weight, waist circumference, fat mass percentage, and an increase in calorie expenditure. There was a significant decrease in autonomous motivation ( $p = .022$ ) and a significant increase in dietary self-efficacy ( $p = .042$ ). Physical activity self-efficacy as measured by Physical Activity and You did not significantly increase ( $p = .861$ ).

**Table 5.2: Mean Changes in Outcome Measures from Baseline to 10-week follow-up**

	<b>Baseline Mean <math>\pm</math> SD</b>	<b>Follow-up Mean <math>\pm</math>SD</b>	<b>p-value for change</b>
<b>Weight Loss (kg)</b>	87.8 $\pm$ 13.9	87.1 $\pm$ 14.9	.527
<b>Waist Circumference (cm)</b>	99.3 $\pm$ 13.8	96.7 $\pm$ 12.7	.200
<b>BMI (kg/m<sup>2</sup>)</b>	33.0 $\pm$ 5.7	32.8 $\pm$ 5.8	.517
<b>Percentage Fat Mass</b>	38.5 $\pm$ 9.5	38.0 $\pm$ 10.6	.725
<b>WEL-Q (diet self-efficacy)</b>	113.2 $\pm$ 27.2	131.6 $\pm$ 23.3	.042
<b>Physical Activity Self-efficacy</b>	10.0 $\pm$ 3.95	10.80 $\pm$ 3.3	.861
<b>TSRQ Autonomous</b>	6.2 $\pm$ .52	4.6 $\pm$ 1.4	.022
<b>TSRQ Controlled</b>	3.9 $\pm$ .95	3.4 $\pm$ .42	.195
<b>Social Support</b>	72.4 $\pm$ 6.8	72.0 $\pm$ 11.2	.948
<b>Increase in Physical Activity (kcal/week)</b>	1465.0 $\pm$ 875.1	2000.0 $\pm$ 1113.0	.363

### *Correlations*

There was a significant correlation between baseline weight and follow up weight ( $r = .986$ ,  $p < .001$ ). Likewise, there was a significant correlation between baseline BMI and follow up BMI ( $r = .987$ ,  $p < .001$ ) as well as a significant correlation between baseline fat mass percentage and follow-up fat mass percentage ( $r = .963$ ,  $p < .001$ ). The weight change range was a gain of 2.4kg to a loss of 4.5kg.



Baseline autonomous motivation as measured by the TSRQ was positively correlated with weight change ( $r = .899$ ,  $p = 0.038$ ) over time.

Attendance was negatively correlated with post controlled motivation ( $r = -.883$ ,  $p = .047$ ).

Table 5.3 addresses the correlations between weight change and attendance and weight change and number of self-monitoring journals completed. It also shows the correlations between weight change and baseline social support, baseline self-efficacy, and baseline autonomous motivation. No associations were found between weight loss and attendance, weight loss and number of self-monitoring journals completed, and weight loss and social support. The lack of correlations among these variables does not support previous research.

**Table 5.3: Correlates of Weight Loss**

	<b>Correlation</b>
Attendance	$r = .646, p = .166$
Self-monitoring journals	$r = .318, p = .539$
Baseline Social Support	$r = -.405, p = .426$
Baseline Dietary Self-efficacy	$r = .644, p = .241$
Baseline PA Self-efficacy	$r = -.180, p = .733$
Baseline Autonomous motivation	$r = .899, p = .038$

## **Chapter 6: Discussion**

This study found baseline autonomous motivation to be positively correlated with weight change. This is consistent with recent findings of Furia et al.'s (2009) study of 300 college students on motivation for achieving and maintaining a healthy weight, in which they found increased autonomous motivation to be correlated with successful weight loss outcomes. This finding is also supported by Butler and Mellor's (2006) study which found motivation to be associated with participation and perseverance in weight maintenance behaviors. Also consistent with this finding are the results of Williams et al.'s (1996) study which found autonomous motivation to be an important predictor of whether a weight loss program is successful in promoting weight loss, and weight loss maintenance. Individuals with high autonomous motivation at baseline may be more successful with weight loss than those with low autonomous motivation.

Autonomous motivation decreased over time for the aggregate sample. This is similar to the results found in a study by Webber and colleagues (2009) which found a significant decrease in autonomous motivation during a 16 week period. There are several possible reasons that autonomous motivation declined over time. Perhaps after beginning the program, participants realized that weight loss or the weight loss program was not as easy as they anticipated. Participants also may have lost interest when they did not see rapid weight loss. Thus, as time went on they experienced a decrease in motivation to lose weight.

Dietary self-efficacy increased over time, which is similar to what previous studies have found (Clark et al., 1991; Marcus et al., 1992; Roach et al. 2003; Warziski et al., 2007). Results from an 18 month behavioral weight loss study found improvement in self efficacy was associated with weight loss over time (Warziski et al., 2007). Similar

results were found in a study designed to increase self-efficacy for weight loss promotion among young adults. During this intervention participants attended 12 weekly sessions which consisted of nutrition education and activities to promote self – efficacy for weight loss. Roach and colleagues (2003) found that as self efficacy improved, eating habits improved and weight loss increased.

One possible explanation for the increase in self-efficacy may be due to participants responding to the weekly lessons. They may have found lessons were helpful and therefore they believed they could successfully lose weight on their own.

While this sample size was too small to analyze statistically, it appears that the face-to-face group was more participative than the online program as evidenced by attendance rates. The online group turned in more completed self-monitoring diaries; however, they were all from one person. These areas should be explored further in future studies.

Several studies have shown associations between weight loss and attendance (Orth et al., 2008; Steele et al., 2007), weight loss and self-monitoring (Kruger et al., 2006; Wing et al., 2007), and weight loss and social support (Krukowski et al., 2008). However, the lack of correlations among weight loss and attendance, weight loss and self-monitoring diaries, and weight loss and social support were likely due to the small sample size.

## **Limitations**

There were several limitations to this study including a small sample size and a high attrition rate. The study began with 15 participants and only 6 participants completed follow-up assessments. The small sample size made it difficult to assess whether an online behavioral weight loss program or a face-to-face program would produce greater weight loss.

There are several possible reasons for the low enrollment in the study. The first was a front page article in the Kentucky Kernel about an exercise program offered at the Johnson Center (the University of Kentucky's gym) the same day the ad for Fit Camp was in the paper. Another possible reason was due to limited funds, the advertisement for this study could only be placed in the personal ad section of the school newspaper. Another limitation was the BMI requirements for participation. A few students were interested in participating; however, their BMI's were over 40. Finally, there were several hundred glossy colored flyers posted around campus. However, the flyer was a picture of a male who did not appear to be overweight.

Despite the limitations, this study did find baseline autonomous motivation to be positively correlated with weight loss and self-efficacy significantly increased from baseline to follow-up.

## **Chapter 7: Conclusions and Recommendations**

Although autonomous motivation decreased over time, autonomous motivation was positively correlated with weight loss, and self-efficacy significantly increased over time.

Future studies should investigate how best to advertise a behavioral weight loss program to college age students by conducting focus groups. Flyers should include pictures of both overweight males and females instead of just one male who appeared to be a healthy weight. Individual motivational interviewing throughout a behavioral weight loss study may help with participant motivation, therefore decreasing attrition rates. In addition to weekly lessons, incorporating hands-on activities such as healthy cooking lessons and physical activity sessions may keep participants interested in participating in the entire study.

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