Participation in immersion weight loss treatment may benefit, not harm, young adult staff members

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Participation in Immersion Weight Loss Treatment May Benefit, Not Harm, Young Adult Staff Members

by

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Abstract

American teens and young adults are at risk for developing pathological eating patterns, which can lead to eating disorders and obesity. Despite the success of weight management programs for obese individuals, some researchers caution that participation in an aggressive approach to weight management could promote the development of eating disorders. The current study evaluated the risks of following a weight management program for healthy young adults who served as staff members in immersion treatment of obesity over the course of a summer. Participants included Wellspring staff members ($n = 108$) along with a comparison group of young adults with similar demographic characteristics ($n = 136$). Participants completed assessments of eating disorder and obesity risk at three time points: the beginning of the summer, the end of the summer, and a six week follow-up. Wellspring participants lost weight over the course of the summer, and weight loss related to initial BMI, such that those at higher BMI levels at the beginning of the summer lost more weight. Comparison participants’ weight status remained unchanged during the summer. Wellspring staff members also evidenced increases in dietary restraint, but not in eating disordered behaviors, over the summer. Increases in dietary restraint appeared to facilitate appropriate weight reduction for Wellspring participants. Participation as leaders in an immersion weight loss program seemed to benefit, not harm, young adults, suggesting advantages for using weight controlling interventions in a wide range of individuals.
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Chapter 1: Introduction

Obesity and eating disorders represent two pervasive problems for young people in Western culture. For example, 18 percent of Americans between ages 12 and 19, and 30 percent of Americans between the ages of 20 and 39 are currently obese (Ogden, Carroll, Kit, & Flegal, 2012). In addition, millions of adolescents and young adults struggle with eating disturbances (Mintz & Betz, 1988; O'Dea & Abraham, 2002; Tylka & Sublich, 2003). Eating pathology and obesity promote the occurrence of many psychological problems and medical conditions, and these two issues increase morbidity and mortality (United States Office of the Surgeon General, 2001; Wilson, Fairburn, Agras, Walsh, & Kraemer, 2002).

1.1. Does Dietary Restraint Promote Eating Disorders AND Obesity?

Some influential models attempt to explain the development of eating disorders by proposing that dietary restraint promotes eating pathology (e.g., Fairburn, 2008; Polivy & Herman, 1985; Stice, 2001). These theories suggest that dieting precedes the onset of more pathological eating patterns, including binge eating and purging. Corresponding interventions that attempt to reduce risk for eating disorders in young people often seek to reduce dieting behavior (e.g., Shaw & Stice, 2008). Alternatively, obesity treatment and prevention efforts rely on precisely the opposite approach. The latter interventions attempt to increase dietary restraint to produce successful weight management (National Task Force for the Prevention and Treatment of Obesity, 2000). Notably, a recent intervention that targets healthy weight management for both eating disorder and obesity prevention has shown promising results (Stice, Rhode, Shaw, & Marti, 2012; 2013).
Some healthcare professionals have argued quite vehemently that obesity interventions for children may produce more harm than good; this argument suggests that attempting to get young people to reduce their intake of fat and calories could create eating disorders and will, therefore, also fail to help them lose weight in the long run (e.g., Eneli, Crum & Tylka, 2008; McLaren et al., 2009; Satter, 1986). Others have just as vituperatively countered these arguments (e.g., Kirschenbaum et al., 2009; Kirschenbaum & Kelly, 2009; Lowe, 2003).

1.2. Dietary Restraint May Prove Helpful, Even to Those Currently at Healthy Weights

Part of the argument in favor of promoting dietary restraint in a wide range of people relates to the worldwide epidemic of obesity (World Health Organization, 2000). While engaging in dietary restraint once seemed unnecessary for healthy weight individuals, most people in industrial nations now face demands to restrain caloric intake. Researchers suggest that most of us now face a “toxic environment” which includes living sedentary lifestyles and having an abundance of available calories (Brownell & Horgen, 2004). This environment requires that most individuals engage in some level of dietary restraint in order to maintain a healthy weight (Lowe & Levine, 2005). Furthermore, individuals who are slightly or moderately overweight will likely benefit from engaging in dietary restraint to lose excess weight and reduce risk for additional excess weight gain over time (Gorin et al., 2008).

In addition to practicing weight management strategies to prevent weight gain, another reason that healthy weight individuals may choose to follow a dieting
plan includes supporting friends and family that are attempting to lose weight. This scenario may be of particular relevance when a family seeks to help an obese child. Research suggests that parental support, including engaging in self-monitoring and losing weight oneself, promotes the success of overweight children in weight loss treatment (Boutelle, Cafri, & Crow, 2012; Hinkle, Kirschenbaum, Pecora & Germann, 2011). In this instance, healthy weight parents and siblings may assist an overweight child in losing weight and maintaining a healthy weight by following a diet plan designed for weight management.

1.3. Toward Settling the Debate

Current scientific knowledge cannot yet settle this debate. We do not yet know, for example, under which conditions dieting produces more harm than good. That makes it difficult to answer such important questions as: What happens when people at healthy weights immerse themselves in weight losing environments, for example in homes or spas or weight loss camps in which weight controllers dominate? Therefore, evaluating the effect of living in environments that stress structured weight management plans on healthy weight individuals, along with those who are only slightly overweight, seems important. Relevant questions include whether living in such weight controlling environments promotes healthy weight management for those at healthy or near-healthy weights or causes proliferation of eating pathology.

Counselors and other staff members at weight loss summer camp represent an example of healthy weight individuals who find themselves in a weight-controlling environment. Such environments afford a unique opportunity to assess
the effects of weight-loss oriented diet and exercise program on individuals with a wide range of weight histories and statuses. Previous studies of empirically-designed weight loss camps show that obese campers lose significant amounts of weight in such immersion treatment programs that include cognitive-behavior therapy, and that substantial percentages of these individuals seem to maintain weight loss during one year or longer follow-ups (Kelly & Kirschenbaum, 2011). No study has yet examined the weight trajectory or psychological outcomes of camp staff within these weight-controlling environments.

The current study evaluated the impact of participating as leaders in Wellspring Camps on young adult staff members, the vast majority of whom were at healthy weights. More specifically, we examined to what extent participating in an immersion program focused on dietary restraint via a very low fat diet would promote the development of eating disorders and excess weight gain. We anticipated that this study could inform etiologic models of eating pathology and provide an empirical demonstration of the potential value of dissemination of dieting interventions to a wide range of individuals.

1.4. Hypotheses

Overall, we hypothesize that Wellspring staff members will evidence increased levels of dietary restraint without a development of eating disorder risk. On the contrary, we believe that participating in a controlled dieting intervention will relate to static or increased body satisfaction along with static or decreased levels of disinhibition, binge-eating, and perceived hunger. Individuals in the Wellspring condition should also evidence weight loss over the summer.
Furthermore, we expect an inverse linear trend between initial BMI and shift in BMI, such that staff members who are overweight will evidence the most weight loss, with BMI changes diminishing at lower initial BMI levels. Such a trend would provide evidence that a weight-loss diet can produce changes in BMI that mirror individual needs without enhancing risk for becoming underweight or developing AN. The hypothesized model of change, based on the literature reviewed in Chapter 2, is outlined in Figure 1.
Chapter 2: Literature Review

2.1 Dietary restraint, weight trajectory, and caloric restriction differ from one another

Etiological models of eating disorders, including the dual pathway model of Bulimia Nervosa (BN) (Stice, 2001), the cognitive-behavioral model of Anorexia Nervosa (Fairburn, Shafran, & Cooper, 1999) and BN (Fairburn, Marcus, & Wilson, 1993), and the transdiagnostic model of eating disorders (Fairburn, 2008), suggest that dieting, defined as the intentional and consistent restriction of caloric intake for weight management purposes, promotes eating disturbance.

Research that supports such models often relies on self-report measures of dietary restraint, or the degree to which individuals employ cognitive effort to eat less than they would like, rather than an evaluation of true caloric restriction or weight trajectory. Researchers have developed several dietary restraint scales to measure this cognitive variable. The most popular of these measures include the Restraint Scale (Herman & Polivy, 1980), the restraint subscale of the Three Factor Eating Questionnaire (Stunkard & Messick, 1985), and the Dutch Restrained Eating Scale (Van Strien, Frijters, Bergers, & Defares, 1986). Studies have found that, although these measures capture a similar concept, they are not entirely analogous (Lowe & Maycock, 1988; Wardle & Beals, 1987). For example, some studies suggest that the DRES and the TFEQ relate to caloric restriction to a greater degree than the RS (Laessle, Tuschl, Kotthaus, & Pirke, 1989). In response to noting differences among these scales, researchers developed a hypothesis that the DRES and the TFEQ-R capture successful dieting, while the Restraint scale captures unsuccessful
dieting (Heatherton, Herman, Polivy, King, & McGree, 1988). These researchers posited that unsuccessful dieting is most predictive of future eating problems, including binge eating and purging.

More recently, research has evaluated this hypothesis and found that the DRES and RS were equally predictive of bulimic symptoms when questions related to disinhibition were removed from the RS (Stice, Ozer, & Kees, 1997). Furthermore, studies consistently indicate that all three of these scales do not consistently predict caloric intake in a variety of situations (e.g. laboratory test meal, 3-month meal purchases at a university cafeteria) and populations (eating disordered, healthy, or obese individuals) (Bathalon et al., 2000; Rolls et al., 1997; Stice, Cooper, Schoeller, Tappe, & Lowe, 2007b; Stice, Fisher, & Lowe, 2004; Stice, Sysko, Roberto, & Allison, 2010; Tuschl, Platte, Laessle, Stichler, & Pirke, 1990).

A close look at those who report high levels of dietary restraint on the aforementioned measures shows that many of these individuals are not reaching a state of true negative energy balance. Bathalon et al. (2000) examined the predictive validity of self-reports of dietary restraint by examining individuals’ caloric intake over an eighteen-day period and utilizing a biological marker of doubly-labeled water. These authors found that dietary restraint scores did not correlate with caloric intake. Thus, individuals who attempted to restrain their diet showed similar caloric intake to nonrestrained eaters. Other studies have replicated these findings, which show that restrained eaters consistently consume a similar number of calories compared to non-restrained eaters over time (Martin et al., 2005; Stice et al., 2004; Stice et al., 2007). Another study found that many people report intake
below minimal needs for survival, and that this tendency is most pronounced for obese individuals (Klesges, Klem, Epkins, & Klesges, 1991). Such evidence suggests that individuals generally underreport caloric intake. This body of evidence also indicates that, currently, no dietary restraint measure exists that predicts successful dieting.

Although these restraint scales appear to be inadequate measures of successful dieting, the construct that they capture nonetheless represents an important phenomenon. Most notably, restraint measures consistently predict the development of eating disorders over time (Klesges et al., 1991; Stice et al., 1997; Stice, Nemeroff, & Shaw, 1996; Stice, Shaw, & Nemeroff, 1998). Cognitive dietary restraint represents a risk factor for eating pathology, despite the fact that it is only weakly related to caloric intake and weight trajectory. An important endeavor, then, includes examining mediators, moderators, and mechanisms associated with this risk factor, along with determining the risks and benefits associated with specific dietary restraint strategies.

Many explanations may elucidate the relationship between restraint, caloric restriction, and weight loss. Individuals who place a high value on the importance of dietary restraint, for instance, may over-report the degree to which they diet on cognitive restraint measures. In addition, individuals may show large variability in their success at dieting efforts within a short time frame. Environmental variables may influence the success of restraint efforts such that restrained eaters may evidence more success under specific circumstances. Furthermore, it is possible that some individuals who do not evidence elevated restraint scores may nonetheless
lose weight as a result of sickness, decreased appetite, or increased energy expenditure through exercise. The relative difficulty of long-term dietary restraint is supported by many prospective studies which indicate that high scores on dietary restraint scales typically correlate with weight gain, not weight loss, over time (Lowe, Davis, Lucks, Annunziato, & Butryn, 2006; Stice, 1998; Stice, Presnell, & Spangler, 2002).

Notably, dietary restraint measures also do not capture the degree to which an individual is following an eating plan for weight loss purposes. Studies examining self-reported goals for engaging in dietary restraint indicate that the majority of individuals who report dieting state that they are dieting to maintain rather than to lose weight (Lowe et al., 1996), further complicating any evaluations of dietary restraint as a risk factor for eating pathology and weight trajectory.

The aforementioned findings indicate that dietary restraint, caloric restriction, and weight loss represent distinct concepts related to eating disorder risk. It is important to understand the obesity and eating disorder risk associated with each of these concepts in the presence and absence of one another, and a careful examination of such variables will prove vital for developing interventions that promote physical and psychological health.

2.2 Counterregulatory eating as a risk associated with dietary restraint

In 1975, researchers conducted the first studies examining the relationship between cognitive dietary restraint and caloric intake in a controlled experiment (Herman & Mack, 1975). These authors found that individuals who scored high on the RS were more likely to increase the amount of ice cream that they ate relative to
those reporting low scores on the RS following a preload intake of a milkshake. When they did not receive the milkshake preload, restrained eaters would eat less than unrestrained eaters, consistent with their reports from the RS. These authors theorized that when restrained eaters consume a food that is inconsistent with their restraint goal, this produces a disinhibited state in which they then are more likely to overeat. This phenomenon is termed “counterregulatory eating” (Federoff, Polivy, & Herman, 1997; Heatherton, Polivy, & Herman, 1991; Polivy, Herman, & Deo, 2010). Furthermore, studies indicate that such a disinhibited state can be primed from a variety of situations including alcohol intoxication, interpersonal stress, and negative mood induction (Polivy & Herman, 1976a; Polivy & Herman, 1976b; Tanofsky-Kraff, Wilfley, & Spurrell, 2000). These experiences all appear to increase a restraining individual’s subsequent food intake while decreasing the food intake of a nonrestrained eater. Such findings are consistent with etiologic models of eating disorders that suggest dieting precedes and promotes binge eating.

As these episodic counterregulatory experiences continue, restrained eaters may need to eat more on future occasions to feel satiated (Polivy & Herman, 1985). In addition, obese and overweight individuals on weight loss diets show decreases in resting metabolic rate after caloric restriction (Heilbronn, Jonge, & Frisard, 2006; Martin et al., 2007). Thus, counterregulatory eating experiences coupled with a potential increase an individual’s metabolic efficiency due to restraint status could explain some of the increase in BMI that is predicted by dietary restraint in longitudinal studies.
Counterregulatory eating, over time, may also promote binge eating and purging in accordance with etiological models of eating disorders (Heatherton & Polivy, 1992). One prospective study also found that peak age of binge eating in a community sample occurred two years prior to the peak onset of purging, and dietary restraint predicted the onset of both behaviors (Stice, Killen, Hayward, & Taylor, 1998). Results from this investigation indicate that binge eating sometimes precedes onset of hazardous weight control methods. Thus, dietary restraint may put individuals at risk for binge eating, and then binge eating may lead to purging as a method to regain control over caloric intake.

Notably, however, several research teams have failed to replicate this counterregulatory eating phenomenon in situations that stray from the experimental paradigm utilized by original counterregulatory research (e.g. Lowe & Maycock, 1988). Thus, the counterregulatory hypothesis may not generalize well to a variety of foods and alternative conditions. In addition, while many BN patients report a period of dieting prior to their eating disorder onset, this is not a universal experience (Polivy & Herman, 1985). Furthermore, many individuals with binge eating disorder do not report a history of dieting prior to onset of binge eating (Abbott et al., 1998; Spurrell, Wilfley, Tanofsky, & Brownell, 1997), indicating that while dieting may promote problematic eating patterns, it is not necessary for the development of binge eating. While counterregulatory eating could certainly provide some explanation regarding the relationship between dietary restraint, eating pathology, and weight trajectory, many other factors likely inform this model,
and examining more broad psychological theories may assist in an evaluation of these variables.

2.3. Perceived Deprivation

One view of restrained eating includes that it is a state of perceived deprivation, which may or may not match one’s physiological state in which individuals are tempted by palatable foods in the environment and work towards resisting that temptation, and it can occur with and without dieting (Markowitz, Butryn, & Lowe, 2008). It seems likely that restrained eating is prevalent in environments where there is an abundance of calorically dense foods without producing weight loss. At a Thanksgiving table, for instance, one might “restrain” what they eat by only getting one plate full of food while still ingesting a large number of calories.

Timmerman and Gregg (2003) evaluated perceived deprivation in a study that examined potential differences between cognitive and physiological satiation. These authors utilized a visual analogue scale in which participants answered two questions: 1. I feel like I ate enough food today, and 2. I feel like I ate what I wanted today, where ratings on these two scales represented perceived deprivation. These authors found that perceived deprivation was correlated with scores on the restraint scale, though it was not correlated with caloric intake in a sample of binge eaters and current dieters. Markowitz et al. (2008) replicated this finding in normal weight college students without a history of an eating disorder. It follows, then, that restraint scales may be associated then with limiting what types of foods are eaten rather than actual caloric intake. Such an approach may be particularly problematic
if it is coupled with limited nutritional knowledge. If individuals believe that they should stay away from carbohydrates, for instance, they may restrict intake of nutritionally innocuous foods while eating an abundance of other, calorically dense, foods. Feeling deprived after resisting tempting foods, then, may put individuals at risk for excess eating even if they are otherwise at a neutral or positive energy balance, and such situations could eventually lead to weight gain.

In accordance with these findings, a study by Presnell, Stice, & Tristan (2008) found more evidence that many of those who consider themselves on a weight loss diet were not achieving an energy deficit. This study randomly assigned self-reported chronic dieters to a “diet as usual” or a “eat as if you would if you were not dieting” condition. Those in the “dieting as usual” condition did not lose weight; however, those who were in the “no diet” condition actually gained more weight. These findings suggest that those who score high on restraint scales may simply be restricting in a sense by eating less than they would like, without achieving enough deficit in caloric intake to promote weight loss. Similarly, Lowe & Levine (2005) suggested that the brain has two systems that regulate eating – one related to physiological hunger when one is deprived of energy and another, which is activated by the presence of highly palatable food. Palatable food is abundant in many environments, creating the need for individuals to engage a restraint system in order to eat less than they desire.

2.4. Dietary restraint as self-regulation

One helpful way to conceptualize dietary restraint is as self-regulation. Individuals who score high on dietary restraint scales engage in self-regulation by
attempting to curb the automatic process of eating at-will. The effectiveness of self-regulation, then, may determine the risk for health-related problems. Kanfer (1970) suggests that self-regulation consists of three stages: self-monitoring, self-evaluation, and self-reinforcement. Self-monitoring includes deliberately attending to one’s behavior, and self-evaluation involves comparing one’s self-monitoring data with their ideal behaviors. Self-reinforcement is then reacting to this evaluation. In the case of restrained eating, self-monitoring may be inconsistent, and self-evaluation may include unrealistic ideals. Therefore, individuals may experience self-reinforcement for only extreme dieting behaviors. Successful weight loss, on the other hand, involves very consistent self-monitoring and realistic ideals for self-evaluation. Thus, dietary restraint may put one at risk for eating pathology if it is not practiced with consistent self-monitoring and realistic goals. When dietary restraint includes accurate self-monitoring and appropriate goal setting, self-regulation theory would predict dietary success.

Recent studies have evaluated dietary restraint as a self-regulation strategy (Papies, Stroebe, & Aarts, 2007, 2008, 2009; Stroebe, Papies, & Aarts, 2008). These studies suggest that many restrained-eaters fail at self-regulation. Restrained eaters simultaneously hold goals of dieting and weight control along with the goal of eating pleasurably. Individuals may typically behave in accordance with these dieting goals, though environmental cues, including the presence of highly palatable food, can temporarily lead dieters astray. Such a theory has been evaluated experimentally (Stroebe, 2008), and studies indicate that food descriptions often activate hedonic thoughts in restrained eaters (Papies, et al., 2007).
Fischback, Friedman, and Kraglanski (2003) posited a different model in which dieters may successfully regulate their caloric intake. When restrained eaters consistently attempt to self-regulate in tempting situations, temptation will eventually be paired with long-term goals and successful dieting. These authors found that priming an individual with tempting food words (e.g. chocolate) activated dieting goals for successful dieters, while it did not activate these goals for unsuccessful dieters, and such findings were replicated by another research team (Papies et al., 2008). Together, these studies indicate that successful dietary restraint is possible, and that cognitive processes may influence the degree of success that one experiences. One might consider unsuccessful dietary restraint, and ultimately binge eating and purging, to be a breakdown in self-regulation. Providing individuals with tools to self-regulate successfully, then, should diminish problematic eating patterns and promote healthy weight management.

2.4. 1. When self-regulation fails

Baumeister, Heatherton, and Tice (1994) examined self-regulation failures and found that several processes relate to ineffective regulation, including conflicting standards, reduction of self-monitoring, inadequate strength due to personal or situational factors, and psychological inertia. Restrained eaters who fail at self-regulation may have a breakdown in regulation in any of these places. A failure in self-monitoring will lead individuals to overestimate the degree to which they are truly restricting calories. Conflicting standards when dieting may include a standard of indulgence with that of thinness. Inadequate strength for restraint may include depletion of resources from other events requiring self-regulation, like
financial strain, and psychological inertia difficulties may include engaging in situations in which self-regulation failure is likely. These self-regulation issues may place individuals at risk for excessive weight gain. Such experiences of failure could also place both healthy and overweight individuals at risk for eating pathology, including binge eating and purging. Alternatively, enhancing success at dietary restraint through promoting effective self-regulation may mitigate the risk for unhealthy eating patterns. Teaching effective self-regulation strategies for weight management seems important for both the prevention and treatment of obesity, as even the most metabolically gifted individuals may be at risk for weight gain and eating pathology in the Western world (Brownell & Horgen, 2004).

2.4.2. The importance of self-monitoring

Based self-regulation theory, one mechanism that can improve success in reaching a goal is self-monitoring. Indeed, regularity of self-monitoring predicts success in dieting (Butryn, Phelan, Hill, & Wing, 2007; Kirschenbaum, 1987). For instance, Butryn et al. (2007), found that individuals from the National Weight Control Registry (NWCR) who weighed themselves more frequently had a lower BMI. No research has yet examined the impact of self-monitoring on healthy individuals, and such an approach may assist these individuals in maintaining a healthy weight status. Successful individuals in the NWCR also evidenced high cognitive restraint scores along with their success in self-monitoring and maintaining a significant weight-loss (> 30 pounds for >1 year). Such results indicate that restraint does not always predict weight gain and poor self-regulation. For
weight-loss dieters, high restraint scores are expected, and such scores relate to successful self-monitoring and caloric restriction in some samples.

2. 5. Dietary restraint and its relationship to weight trajectory

As evidenced by individuals in the NWCR, restraint does not always predict weight gain and eating pathology. In some circumstances, dietary restraint can predict healthy weight management, and one important point to consider when evaluating the relationship between restraint and eating disorder risk is weight status and trajectory. Interestingly, overweight status and a range of eating disordered behaviors often co-occur in individuals, both simultaneously and by crossing over from one condition to another over time (Haines & Neumark-Sztainer, 2006). Furthermore, approximately 10% of individuals currently seeking treatment for an eating disorder are currently obese, and 30% of individuals who present at an eating disorder clinic report a history of obesity (Villarejo et al., 2012). In addition, Fairburn, Welch, Doll, Davies, and O’Connor (1997) found that the odds of being an obese child were three times higher among healthy-weight individuals with BN compared to healthy-weight controls. It is clear from this evidence that obesity and eating disorders are not mutually exclusive conditions. This transition between obese, overweight, and normal weight status in individuals with eating disorders suggests that these individuals use dietary restriction strategies inconsistently over time, varying between periods of relative caloric restriction and other periods of caloric disinhibition, which produces fluctuations in weight.

One important predictor of eating disorder risk may be the long-term success of an individual’s restraint efforts. Overall, restrained eaters who successfully lose
weight show less risk for eating pathology over time compared with those who are unsuccessful in their restraint efforts. For example, one study found that a small subsample of middle school girls evidenced an age-adjusted reduction in BMI over any of three sequential 1-year intervals (Stice, Martinez, Presnell, & Groesz, 2006). Most of these girls also scored higher than the median score on the dietary restraint scale. These girls were then compared with other girls in the sample who had similar initial BMI levels. They displayed similar dietary restraint, bulimic symptoms, and depressive symptoms at baseline compared to those who did not lose weight; however, follow-up analyses indicated decreased bulimic and depressive symptoms in these girls compared to others. This study suggests that successful weight-loss dieting does not induce bulimic symptoms, as would be expected from self-regulation theory.

Weight history and weight trajectory may also moderate the effects of dietary restraint on individuals. Lowe, Whitlow, and Bellwoar (1991) completed a study on this topic by investigating weight status, dieting, and restrained eating as separate entities. The authors separated participants into three groups for analyses: restrained dieters, restrained nondieters, and unrestrained nondieters. This study found that restrained, normal weight dieters overate without a preload, while both unrestrained and restrained nondieters ate more following a preload. Overweight nondieters, on the other hand, were more likely to overeat compared to overweight dieters regardless of restraint status. Such results were replicated in an additional study (Lowe, 1995). These findings indicate that whether one is actively trying to lose weight moderates the effect of restraint. Typical counterregulatory eating that
occurs after preload intake appears to be present in restrained eaters who are not currently trying to lose weight, though it occurs less consistently in those who are currently dieting to lose weight along with overweight restrained eaters.

Another theory regarding the connection between restraint and weight gain suggests that one’s weight history might affect the degree to which individuals engage in dietary restraint strategies. Some evidence suggests that dietary restraint may not be a causal mechanism for inducing weight gain, as one study found that, longitudinally, body mass index (BMI) predicted restrained eating to a greater degree than restrained eating predicted BMI (Snoek, van Strien, Janssens, & Engels, 2008). While dietary restraint and weight gain often correlate, those who exhibit high levels of restraint may not gain any more weight than weight-matched, non-restraining individuals over time.

Altogether, the picture of the relationship between dietary restraint and weight trajectory is muddled. It appears that restraint predicts future weight gain in many individuals. Restraint may induce weight gain through a feeling of perceived deprivation that leaves individuals vulnerable to excessive eating, including counterregulatory eating. Eating disordered individuals often show a history of weight fluctuation, and those with eating disorders are likely to have struggled to maintain a healthy weight as a child. An alternative theory of the relationship between restraint and weight trajectory suggests that overweight individuals and individuals that are gaining weight may be more likely to practice restraint over time, which could explain some portion of the relationship between restraint and weight gain. Ultimately, it appears restraint does not universally promote caloric
disinhibition and weight gain, and some individuals are successful in losing weight while in a “restrained” state. These individuals are likely to self-monitor their weight and caloric intake consistently, and cognitively pair calorically dense foods with dieting goals rather than a feeling of deprivation.

2.6. Risks and benefits associated with caloric restriction

Initial admonishments about caloric restriction arose from a study in 1950 examining conscientious objectors to WWII (Keys, Brozek, Henshcel, Mickelsen, & Taylor, 1950). These healthy weight individuals were placed on a highly restricted diet over the course of 6-months. Following the trial, the men experienced depressed mood and preoccupation with food and eating similar to individuals with AN. The findings from this trial are striking, and they indicate the marked effect of severe caloric restriction on normal-weight individuals.

2.6.1 Caloric restriction can be beneficial

Since that time, much research suggests that practicing effective caloric restriction does not increase eating pathology. The National Task Force on the Prevention and Treatment of Obesity (2000) recently concluded that dieting in obese and overweight individuals does not have adverse psychological and behavioral effects. Obese individuals who lose weight evidence reductions in depression and anxiety (Wadden, Foster, & Letizia, 1994; Wadden & Stunkard, 1986). Evidence also suggests that obese individuals who engage in behavioral weight loss programs with caloric restrictions of 1000-2000 k/cal per day do not appear to be at high risk for the development of binge eating (Porzelius, Houston, Smith, Arfken, & Fisher, 1996; Sherwood, Jeffery, & Wing, 1999).
Another study found that obese women assigned to a diet of 1,000 calories a day of liquid meal replacements for 12 weeks did not develop binge-eating disorder (Wadden et al., 2004). In this study, women on a meal replacement diets evidenced similar ratings of hunger, disinhibition, and binge eating compared with women on a more moderate diet of 1,200 to 1,500 calories a day and those assigned to non-dieting. Women on the meal replacement diet showed slightly more binge eating as compared to other groups at 28 weeks, though this increase was not sustained at later follow-up points. In addition, Reeves et al. (2001) actually found reductions in binge eating in obese individuals after a calorie-restricted diet, and another investigation found that obese patients with BED treated on a calorically restrictive diet decreased weight and binge eating episodes over six months (Marcus, Wing, & Fairburn, 1995). Results from such investigations suggest that even significant caloric restriction does not lead to binge eating in obese individuals. This news is encouraging as it suggests that placing overweight individuals on weight loss diets appears relatively safe.

Studies also suggest that caloric restriction does not produce binge eating in normal weight individuals. For example, Presnell and Stice (2003) found that assignment to a six-week low calorie weight loss diet actually decreased bulimic symptoms in non-obese women compared to waitlist control. Furthermore, assignment to a low intensity weight-maintenance prevention program reduced risk for weight gain, obesity onset, and bulimic symptoms in normal weight adolescents with body image concerns over the course of three years (Stice, Shaw, Burton, & Wade, 2006). This healthy weight based eating disorder prevention intervention
consistently indicates that engaging in relatively low levels of dietary restraint can decrease risk of both obesity and eating disorders in healthy weight young women, challenging the assertion that dietary restraint increases risk for eating pathology (Annunziato et al., 2009; Stice et al., 2006; Stice, Marti, Spoor, Presnell, & Shaw, 2008). Results from this intervention cast doubt on the dietary restraint theory of the etiology and maintenance of eating disorders, particularly with regards to BN and binge eating.

Ample evidence supports the position that caloric restriction can be very beneficial for obese individuals. Caloric restriction of 10-30 percent, for instance, increases animals’ lives in a linear fashion (Anderson & Weindruch, 2012). These animals also have fewer pathological and physiological changes and benefits of caloric restriction have also been evidenced in primates (Roth et al., 2000). Preliminary evidence also suggests that caloric restriction promotes health in humans. The CALERIE trial of overweight individuals suggests that a 25% calorie for six months reduces both body weight and fasting insulin (Heilbronn et al., 2006). These individuals also evidenced a 24% reduction in body fat (Redman et al., 2007), along with reduced cardiovascular risk (Lefevre et al., 2009).

Additional evidence from examinations of those that eat low-calorie diets in naturalistic conditions also supports the health benefits for caloric restriction. Long-term practitioners of caloric restriction for health benefits evidence reduced triglycerides, fasting glucose, and fasting insulin when compared with control individuals who are matched on age and SES (Fontana, Meyer, Klein, & Holloszy, 2004; Meyer et al., 2006). In addition, individuals on the island of Okinawa, Japan,
have one of the highest life expectancies in the world, significantly longer than mainland Japanese. A comparison of the diets of Okinawans and mainland Japanese indicates that okinawans have a lower caloric intake in early life, life-long low BMI, decreased age-related diseases, and extended lifespan (Willcox, Willcox, Sokolovsky, & Sakihara, 2007).

2.6.2 Adherence as a barrier to successful caloric restriction

The largest drawback to a caloric restriction approach to health promotion to date appears to be adherence. Individuals who were assigned to a 1-year, 20% calorie reduction approach were only able to maintain 11% calorie restriction (Raccette et al., 2007). One study, called the Biosphere 2, included 4 men and 4 women inside a sealed environment for 2 years. During this time, these individuals consumed a low calorie, nutrient dense, mostly vegan diet of 1800-2000 kcal per day and expended significant amounts of energy. During the study, the subjects lost a significant amount of weight and improved blood pressure, glucose, insulin, LDL, and triglycerides (Walford, Mock, Verdery, & MacCallum, 2002). After several months, all of these individuals gained weight and their health markers worsened, highlighting the challenge of sustainability of caloric restriction.

Overall, it seems that restricting caloric intake to a reasonable level given an individual’s energy needs promotes health. Furthermore, successful caloric restriction does not appear to promote eating pathology in many studies. Thus, teaching successful self-regulation strategies for effective caloric management may decrease risk for problematic eating patterns including binge eating and purging.
2. 7. Are there healthy and unhealthy types of restraint?

Without eating less than one would like and engaging in dietary restraint, obese individuals stand little chance of managing their weight to fight against imminent health and psychological consequences. In addition, healthy weight individuals may risk obesity onset without properly regulating their caloric intake. The costs of obesity are great, and it is important to identify effective prevention and treatment efforts. While some forms of dietary restraint may precede more extreme eating patterns and possibly promote the development of eating pathology, the literature reviewed above suggests that not all dieting behaviors increase eating disorder risk. Likely, a variety influences inform the relationship between dietary restraint and eating pathology, and evaluating the risk of specific dietary restraint strategies for a variety of populations seems prudent to ensure that individuals are truly benefiting from such approaches.

In the community, individuals practice a wide variety of weight management strategies. Some of these approaches may be beneficial while others strategies may be risky. Risky approaches, such as those captured by restraint scales in the absence of caloric restriction, could lead to weight gain, binge eating and purging, and decreased body satisfaction. On the other hand, some dieters appear capable of not only avoiding the aforementioned risks, but also producing important health benefits. These dieters report relatively high levels of dietary restraint; however, this restraint is coupled with outcomes including weight-loss and weight-maintenance, decreased binge eating and purging, and increased body satisfaction. In addition, dieting has produced positive outcomes in a variety of populations,
including obese and healthy weight individuals. Therefore, "healthy restraint" appears possible. Defining characteristics of healthy restraint and differentiating healthy restraint from risky restraint is of utmost importance for promoting public health. Interventions that increase healthy restraint can address two costly and sometimes competing health issues.

Certainly, qualitative differences may exist between naturalistic dieting behavior and the type of dieting behavior commonly prescribed in randomized controlled weight loss trials. Dieting in well-controlled studies is prescriptive in nature, minimizing differences of dieting practices between participants. Supervision in a randomized controlled trial may curb the presence of problematic restraint strategies. Naturalistic dieting, by contrast, may include a wide range of dietary restraint practices, including certain types of restraint that promote eating disorder risk.

The estimation of caloric intake likely marks a major difference between restraint as practiced in the community and caloric restriction in controlled trials. Individuals who successfully lose weight often use self-monitoring skills to accurately record their food intake and adhere to caloric restrictions and increases in exercise (Butryn et al., 2007). Furthermore, the consistent underestimation of caloric intake that is found in restrained eaters indicates that many of these individuals do not accurately practice self-monitoring strategies.

Altogether, while naturalistic dieters may be eating less than they would like by avoiding some highly palatable foods, many individuals may not be accurately monitoring their caloric intake to produce effective long-term weight management.
Periods of dysregulation may follow periods of acute caloric restriction for some individuals, creating an internal “restrained” state that does not promote long-term health. This type of restraint is not only unsuccessful in producing sustained weight loss, but it also may promote eating pathology. Successful dieting interventions, on the other hand, may be unrelated to eating pathology, or may even decrease its incidence.

In addition to the fact that both healthy weight and obese individuals can benefit from some restraint strategies, an examination of effective eating disorder and obesity treatment strategies indicate that dietary regulation is a integral component to the treatment of both conditions. Most notably, cognitive behavioral approaches, which are successful in treating both eating disorders and obesity, rely on self-monitoring of food intake (Baker & Kirschenbaum, 1998; Butryn et al., 2007; Fairburn et al., 1993).

Another important part of eating-related treatments is promoting consistent, regular eating patterns. Encouraging individuals to choose consistent times for meals and snacks each day can improve weight-loss outcomes by eliminating superfluous snacking. It can also prevent these individuals from becoming so hungry that they are tempted to eat unhealthy foods. One investigation from individuals in the NWCR, for instance, found that successful weight loss dieters were more likely to eat breakfast than other individuals (Phelan et al., 2009). Furthermore, those who succeed at weight loss eat on average 4.87 meals and snacks per day (Klem, wing, McGuire, Seagle, & Hill, 1997). Thus, maintaining and
regulating a proper eating schedule may represent one component of healthy
dieting that is not a typical restraint strategy.

More evidence highlighting the importance of dietary regulation arises from
studies involving those in treatment for BN. For instance, Shah and colleagues
(2005) found that individuals with BN who normalized eating patterns by eating
regularly evidenced greater treatment gains than those who did not eat regular
meals; patients who reported eating more meals and snacks over a one-month
period had a 70% probability of achieving abstinence from binge eating compared
to a 4% probability of abstinence in those eating fewer meals and snacks.
Regularizing meal patterns and eating a prescribed diet is a type of self-regulation,
and includes restraining oneself from eating at inopportune times and eating
unhealthy items. Such an approach is critical for the success of both eating disorder
and obesity treatment, and likely represents a “healthy” form of dietary restraint.

2.8. Summary

Altogether, studies that examine the effect of low calorie diets on obese
individuals do not find increased rates of binge eating or purging after dieting. In
addition, one recently developed eating disorder prevention intervention
consistently indicates that engaging in relatively low levels of dieting can decrease
risk of both obesity and eating disorders in healthy weight young women,
challenging the assertion that dieting behavior increases risk for eating pathology
(Annunziato et al., 2009; Stice et al., 2006; Stice, Davis, Miller, & Marti, 2008). The
largest challenge to achieving successful weight management for both obese and
healthy weight individuals appears to be sustainability. Any intervention that could
promote successful self-regulation by increasing adherence to an eating plan should enhance healthy weight management in all individuals, without the risk of pathological eating patterns. One such plan that has already demonstrated success with obese adults and adolescents is the Wellspring Plan (WP; Kirschenbaum, 2011). While the effects of an immersion treatment plan on weight loss in obese individuals have been clearly demonstrated, the potential utility of such an approach for the prevention of eating disorders and obesity in healthy individuals risk of has not yet been considered, and the current study proposes to evaluate such an approach.
Chapter 3: Method

3.1. Participants

Participants in this study (N = 244) included staff at Wellspring camps (n = 108), along with a group of comparison participants (n = 136) who were recruited through staff referrals, residential summer camp programs, and summer classes at a large Northeastern university. Staff participants were recruited from four Wellspring Camp locations on the east coast of the United States (see Figure 2 for an outline of participant flow through the study). A power analysis indicates that in order to capture differences with an effect size of .15 between these two groups over 3 time points with a correlation of .5 for repeated measures of a single construct, a total of 116 participants were needed; thus, the current sample meets requirements to detect medium and large effects in the study. To capture smaller effect sizes, (f < .1), a total sample of more than 260 participants would be needed. Thus, the current study may be unable to detect small or very small effects on outcome variables.

3.2. Procedure

This study received approval from the Institutional Review Board at the University at Albany. The primary investigator of this study recruited participants for the study during staff training at each of the four Wellspring camps, which occurred within the first week of employment. Participants first completed an online informed consent form that explained the study. Participation included completing measures on survey monkey at three time points during the summer. In addition, objective height and weight measurements were taken from Wellspring.
participants at the beginning and end of employment. Comparison participants were also asked to provide a verified height and weight measurement at the beginning and end of the summer. Participation was completely voluntary, and staff were informed that their decision to participate in this study would in no way affect their employment. In addition, participants created a unique study ID number in order to enhance anonymity. All study data was identified and connected only by ID number.

Wellspring participants completed their first set of survey measures during the first week of their employment. Wellspring participants were also asked for names and contact information for friends who might be interested in participation. Comparison group participants were asked to complete online survey measures immediately upon recruitment, and they followed the same informed consent procedure as Wellspring Staff members. All participants were recruited within a four-week time period from May-June, 2012.

The second assessment occurred at the end of employment for camp staff and nine weeks after completion of the first survey for comparison participants. The third assessment occurred six weeks after the second assessment for both groups. The first assessment took up to 15 minutes for individuals to complete, and the second and third assessments took approximately 10 minutes time. Participants who participated in all time points received a $10 gift certificate to Amazon.com as compensation for their time. In addition, Wellspring participants were eligible to earn an additional $5 gift certificate for every friend they recruited who also completed the study.
3. 3. The Wellspring Plan

The Wellspring Plan, based on the Healthy Obsession Model (Kirschenbaum, 1987, 2000, 2011), uses the 3-1-8 plan outlined in a book that all campers and staff members read, *The Wellspring Weight Loss Plan* (Kirschenbaum, 2011). All Wellspring staff members also complete a series of short answer and essay questions on this material before camp begins, to be sure that they read and understood the key elements of the 3-1-8 approach. The “3” represents three primary goals: to eat zero fat grams (accepting <20g per day); to move at least the equivalent of 10,000 steps daily measured on a pedometer; and to self-monitor 100% of food and activity. The “1” represents the over-arching mission – to develop a healthy obsession. Finally, the “8” identifies 8 steps recommended to help understand the rationale for the three primary goals and to develop robust healthy obsessions, from Step #1 “Make the Decision”, #2 “Know the Enemy- Your Biology”, #3 “Eat to Lose”, #4 “Find Lovable Foods that Love you Back”, #5 “Move to Lose”, #6 “Self-Monitor and Plan Consistently”, and #7 “Understand and Manage Stress”, and Step # 8 “Use Slump Busters to Overcome Slumps.” Evaluations of Wellspring’s programs have demonstrated substantial promise, including large and sustained changes in weight status for many participants (Kelly & Kirschenbaum, 2011; Kirschenbaum, 2010; Kirschenbaum et al., 2007).

While staff members had the opportunity to consume as many calories as they would like during the day, all foods that are available on site are very low in fat. Staff members were instructed to adhere to this diet, and they ate all meals at the camp six days per week. Wellspring staff members also agreed to maintain a high
activity level, which was an essential part of their jobs. A typical day at camp included at least five hours of vigorous physical activity for both campers and staff. Staff members wore pedometers at all times, and they typically accrued more than 15,000 steps (approximately 7.5 miles) per day. The third element to the Wellspring Plan included self-monitoring all caloric and fat intake. Nutrition information for all foods was posted in a prominent location in the camp dining halls.

3.4. Measures

3.4.1. Dieting History Questionnaire (DHQ).

A dieting history questionnaire asked participants about their weight and dieting history. This included whether participants were ever overweight by 10 pounds or more, along with their lowest and highest adult weights and the length of time that they maintained their lowest adult weight. This survey also asked participants to report any diets that they had tried in the past and the success of these dieting attempts.

3.4.2. Body Image Disturbance Questionnaire (BIDQ)

The BIDQ evaluated body image disturbance in our sample (Cash, Phillips, Santos, & Hrabosky, 2004). The BIDQ includes seven items that pertain to appearance-related concerns, mental preoccupation with these concerns, associated experiences of emotional distress, and impairment in functioning and avoidance. Five additional items ask for clarification of responses. This measure evidences high internal consistency (Chronbach’s $\alpha = .89$) and test-retest reliability. The BIDQ also evidences good convergent validity as it correlates with other measures of body image and psychosocial functioning. Body mass index is also related to elevated
BIDQ scores in women (Cash et al., 2004). The BIDQ also evidences good test-retest reliability ($r = .88$) over a 2-week interval (Cash & Grasso, 2005). The BIDQ was evaluated in samples of both men and women, and, unlike some other measures of body image, it evidences acceptable psychometric properties in both genders (Cash et al., 2004).

3.4.3. Three Factor Eating Questionnaire (TFEQ)

The Three Factor Eating Questionnaire (TFEQ) is a 51-item questionnaire that assessed dietary restraint, disinhibition, and perceived hunger (Stunkard & Messick, 1985). The TFEQ has been shown to be internally consistent within each subscale ($\alpha = .79$ to $.93$), and subsscales demonstrate reliability on a 1-month test-retest (Stunkard & Messick, 1985). Furthermore, some evidence that these subscales represent distinct constructs. For instance, high disinhibition, but not restrained eating related to acquired liking for sweet-paired odors in one study (Yeomans, Mobini, Bertenshaw, & Gould, 2009). As with other measures of dietary restraint, the restraint subscale of the TFEQ is only weakly related to weight loss and caloric restriction over time (French, Jeffery, & Wing, 1994; Stice et al., 2004; 2007; 2010).

3.4.4. Eating Disorder Diagnostic Scale (EDDS)

Finally, the Eating Disorder Diagnostic Scale (EDDS) evaluated eating disordered behaviors and diagnosis (Stice, Telch, & Rizvi, 2000). The EDDS was designed as a brief self-report scale for diagnosing anorexia nervosa, bulimia nervosa, and binge-eating disorder. Eating disorder experts have attested to the content validity of the scale, and the scale converges with an interview diagnosis
(mean kappa = .83). The scale also evidenced test-retest reliability \(r = .87\) and internal consistency \(\alpha = .89\). The EDDS has also been shown to be sensitive to changes in eating behaviors and cognitions, as it has previously detected response to eating disorder prevention programs in healthy individuals (Stice, Fisher, & Martinez, 2004). Such a measure, then, could potentially capture changes in eating disorder symptoms in Wellspring staff members.

3.5. Analytic Plan

We examined whether Wellspring staff members, compared to Comparison group members, changed in levels of dietary restraint, disinhibition, body mass index, body image disturbance and eating disorder symptoms. We expected that Wellspring participation would influence the trajectory of dietary restraint, and increased dietary restraint should be coupled with decreased body mass index but not outcomes such as disinhibition and binge eating. In order to evaluate change over time, a multilevel modeling approach was used. Such an approach has many advantages. First, such analyses allow for the examination of random effects in a model, which can be particularly useful when comparing groups across time. Multilevel modeling also confers the advantage of providing robust statistical analyses with missing data (Field, 2009).

IBM SPSS 20 was utilized to complete all statistical analyses. An autoregressive error covariance matrix was defined, as residual error is likely to be correlated within individuals across time (Hox, 2010). While we included slope and intercept within participants as random effects in all models, our primary interests focused on the fixed effects of predictor variables; thus, random effects are reported
but not discussed. Predictor variables were centered prior to analyses. Change from baseline to end-of-summer assessment was examined, including a main effect for time, main effect for Group, and a Group x Time interaction. As eating disorder symptoms vary across gender, gender was entered as a covariate in all models. This analytic process addressed several key research questions:

3. 5. 1. Is the Wellspring Plan safe for camp leaders?

To evaluate this question, we examined the relationship between Wellspring participation and eating disorder risk from the beginning to the end of the summer. Outcome variables of interest included body image disturbance, frequency of binge eating, frequency of compensatory behaviors, disinhibition, and eating disorder diagnosis. Fixed effects of Time, Group, Gender, and a Time X Group interaction within subjects were evaluated.

3. 5. 2. Does Wellspring participation relate to effective healthy weight management during the summer?

Another important question includes whether Wellspring participation relates to effective healthy weight management over the course of the summer. In order to evaluate the relationship between participation as a camp leader and healthy weight management, we examined the trajectory of BMIs during the summer

3. 5. 3. Are changes over the summer sustained in a follow-up period?

Next, we examined whether the findings from the beginning to the end of the summer fit the data when the follow-up time point was added. Main effects of Time and Group, along with Group X Time interactions were evaluated. After evaluating
the linear effects, we added a quadratic effect to the model to determine if a quadratic time effect produced an improved fit to the model.

3. 5. 4. Do characteristics of individuals predict response to participation in the Wellspring program?

It is possible that the Wellspring program may produce differential outcomes based on participant characteristics. In order to evaluate this hypothesis, we examined hypothesized predictors of change within the Wellspring condition for significant Group X Time interactions. Potential moderators were chosen a priori from the model outlined in Figure 1, including initial BMI, weight suppression, and weight-loss goals.

3. 5. 5. Are changes in BMI for Wellspring participants mediated by changes in dietary restraint? For significant Group X Time interactions, we examined dietary restraint as a hypothesized mediator of change, utilizing procedures outlined by several researchers as an appropriate method to evaluate mediators of intervention effects (Kazdin & Nock, 2003; Stice, Presnell, Gau, & Shaw, 2007). Analyses sought to examine the following criteria:

1. Displaying that treatment condition relates to change in outcome
2. Showing that treatment condition relates to change in mediator
3. Change in the mediator over time is significantly correlated with change in the outcome over time in the intervention condition
4. Predictive effect of intervention condition on change in outcome, controlling for change in the mediator, is significantly reduced or
eliminated relative to when the outcome is regressed only on the intervention condition.

Many also outline a fifth criterion for establishing mediation in clinical trials (Kazdin & Nock, 2003; Stice et al., 2007). These authors indicate that an important evaluation of mediation in longitudinal trials includes showing that change in the mediator occurs before meaningful change in the outcome significantly more frequently than would be expected based on intervention condition. As data were not collected at multiple time points during the time when individuals were actively participating at Wellspring Camps, we are unable to properly assess this criterion in the current study. Thus, mediation will be evaluated by the first four procedures only.
Chapter 4 – Results

4.1. Data Cleaning

A synopsis of participant flow through the current study is provided in Figure 2. Altogether, 244 individuals, including 108 Wellspring participants and 136 Comparison participants, were consented into the trial. Four Wellspring participants were removed from analysis, as they did not complete staff orientation or participate as a Wellspring leader during the summer. Additionally, two comparison individuals were removed from the dataset due to inconsistent responses in one or more of the surveys. Ninety-eight percent of participants completed the first survey, 86% completed the second assessment, and 82% completed the 6-week follow-up survey. Seventy-six percent of comparison participants completed all three assessments, along with 81% of Wellspring participants. No demographic differences emerged between those who completed all three surveys and those who did not.

Prior to analyses, we also examined the skewness of potential mediators and dependent variables. Several variables evidenced a positive skew (see Table 2). Transformations were preformed on these variables to correct the skew. In addition, predictor variables were centered prior to analysis. While most answers involved multiple-choice responses, participant weight and height were evaluated in a free response format. When BMI was calculated, four instances were found in which participants reported a BMI outside of a reasonable range (15<BMI<45). In these instances, BMI was compared to reports of BMI from other time points, and, in
each case, errors in responding were corrected (e.g. one participant reported their weight at 1156 pounds as opposed to 156 pounds).

4.2. Participant Characteristics

We examined participant characteristics by group (see Table 1). No baseline differences emerged between Wellspring and Comparison participants with regards to age, weight status, history of dieting, BMI, gender, or ethnicity. Wellspring participants did display a greater degree of weight suppression (16.10 ± 20.51 pounds), the difference between their highest weight and current weight, than comparison participants, (11.45 ±12.37 pounds; \(t(225) = 2.05, p < .05\)). Furthermore, Wellspring participants evidenced higher TFEQ-R scores at baseline than comparison participants, \(t(225) = 2.34, p < .05\). Thus, it follows that more Wellspring participants evidenced successful dieting prior to the start of the study than to comparison participants.

4.3. Eating Disorder Risk

4.3.1 Eating disorder risk from Time 1 to Time 2. Models for eating disorder risk outcomes from Time 1 to Time 2 are presented in Table 6. Variables of interest include: body image disturbance, disinhibition, frequency of binge eating episodes, and frequency of compensatory behaviors. A summary of results by outcome variable is presented below.

4. 3. 1. Body image disturbance. Overall, females reported higher body image disturbance than males in this study. A significant time effect did emerge from Time 1 to Time 2. Over the course of the study, participants evidenced reductions in body image disturbance. Despite this significant time effect, no Time x
Group interaction emerged. Thus, Wellspring and Comparison participants showed similar improvements in body image from the beginning to the end of the summer.

**4. 3. 1. 2. Disinhibition.** The disinhibition outcome variable was measured through the Disinhibition subscale of the TFEQ. Overall, males reported greater levels of disinhibition in this study as compared to female participants. Furthermore, from Time 1 to Time 2, participants evidenced an overall decrease in disinhibition. No Group or Time x Group interactions emerged, indicating that Wellspring participants did not evidence greater reductions in disinhibition than comparison participants during the summer.

**4. 3. 1. 3. Frequency of Binge Eating Episodes and Compensatory Behaviors.** A third eating disorder risk variable that was examined during the summer included frequency of binge eating episodes and compensatory behaviors, as measured by key items on the EDDS. Females reported more binge eating episodes and compensatory behaviors during the study. No additional effects fixed effects emerged from Time 1 to Time 2, indicating that there were no significant shifts in the frequency of such behaviors over the summer in our sample.

**4. 3. 2. Eating disorder risk at follow-up.** To examine how participation as a leader in immersion weight loss treatment might impact the trajectory of eating disorder risk after individuals return home, we repeated initial analyses with the inclusion of the third time point: six-week follow-up. A summary of these results is found in Table 7. In addition to main effects of Gender, a significant linear trend emerged for Disinhibition, Binge Eating, and Body Image Disturbance, such that individuals in both the Wellspring and Comparison groups displayed reductions in
these eating disorder risk variables across the three time points assessed in this study. A quadratic trend also reached significance for binge eating episodes, such that individuals evidenced a slight rebound in binge eating episodes at Time 3. No Group or Group x Time interactions appeared for any eating disorder risk variables.

4. 3. 3. Eating disorder diagnoses. Percentages of individuals in both groups who met criteria for a subclinical or full syndrome eating disorder diagnoses are presented in Table 5. Overall, there were no significant differences between groups in diagnoses, and no significant changes occurred in either group over the course of the summer. Evaluation of cases of eating disorders suggests that individuals who met criteria for an eating disorder at Time 1 were likely to continue to meet criteria at Time 2 and Time 3.

4. 3. 4. Summary of eating disorder risk outcomes. Overall, Wellspring participation did not evidence a robust effect on eating disorder symptoms or eating disorder risk in our sample. Individuals in this trial reported relatively low rates of eating disorders, similar to other nonclinical populations of young adults (Stice et al., 2000; 2004). Thus, there may have been little reduction in symptoms and risk due to the low base rates of specific problematic eating patterns.

Furthermore, while Time x Group interactions did not appear for any of the major eating disorder outcome variables, several outcome variables evidenced a linear time effect across both groups, indicating that both Wellspring and Comparison participants evidenced similar reductions in scores of problematic eating patterns during the summer. Furthermore, these reductions remained significant when the follow-up time point was added to each model. The only
eating disorder risk variable that did not evidence a significant shift during the study included frequency of compensatory behaviors.

### 4.4. Weight Management

A time effect appeared indicating that individuals reduced their self-reported BMI from the beginning to the end of the summer (see Table 8). Furthermore, a Time x Group interaction emerged such that those in the Wellspring condition lost significantly more weight than those in the comparison condition. When the third time point was introduced into the model, the linear and quadratic effects of time continued to reach significance. Furthermore, Time (linear) x Group and Time (quadratic) x Group interactions were also significant. These results indicate that Wellspring participants continued to be successful at weight management during the follow-up period, though, on average, these individuals did regain a small amount of weight during the follow-up period.

To examine additional evidence that Wellspring participants lost weight over the course of the summer, we also evaluated objective BMI of Wellspring participants from Time 1 to Time 2. A significant Time effect appeared, \( B = .21 (.06), p < .05, CI [.14, .27] \), providing converging support that Wellspring participants lost weight over the summer.

#### 4.4.1. Hypothesized predictors of weight loss within the Wellspring group.

Several variables may moderate the relationship between Wellspring participation and weight loss. To investigate potential moderators, we examined only individuals in the Wellspring condition, and evaluated Time X Hypothesized Moderator interactions within this condition. We included the main effect of time, a
main effect for each hypothesized moderator, and the linear Time x Hypothesized Moderator interaction. We then evaluated the quadratic Time x Hypothesized Moderator interaction in a second step. Findings from these investigations are presented in Table 9.

4.4.1. Time 1 BMI. The first moderator of interest included individuals’ initial BMI. If the Wellspring program provides appropriate weight management, one would expect an inverse relationship between initial BMI and weight change over the course of the summer – with individuals at a higher initial weight demonstrating weight loss, with individuals at lower initial weights evidencing weight maintenance over the course of the summer. Thus, we would expect a Time x Initial BMI interaction with regards to the BMI shift over the course of the summer.

Overall, several effects emerged in this model. An initial BMI x Time (linear) interaction appeared, such that those who saw the largest shift in BMI were individuals who entered the summer at the highest BMI levels. Such news is encouraging as it indicates that the individuals at lower initial BMI levels are able to effectively maintain a healthy weight while eating a very low fat diet, while individuals at a higher BMI level are able to lose weight in order to approach a healthier BMI.

In addition to examining BMI continuously, we also evaluated differences between Wellspring and Comparison participants’ weight trajectory based on BMI categorically. We divided participants into three weight categories based on their initial BMI. These categories included a group of participants with a BMI < 23.00, those with 23.00 < BMI < 25.00, and those with a BMI > 25.00. We then added a
Time x Group x Initial Weight Status predictor term to the above model. This 3-way interaction term did reach significance, \((B = -.02, 95\% CI [-.04, -.007])\), and these findings are illustrated in Figure 3.

4. 4.1.2. **Weight suppression.** A second participant variable that may moderate the relationship between wellspring participation and BMI change includes an individuals’ initial level of weight suppression. Studies on weight suppression suggest that individuals who are suppressing weight may have a tough time losing weight, and these individuals may be at risk for weight regain (Lowe et al., 2006a).

An evaluation of weight suppression in the Wellspring participants indicated that, while weight suppression did not evidence a significant main effect on BMI, a Time (linear) x Weight Suppression interaction did emerge. Those who evidenced higher levels of weight suppression at Time 1 were able to lose more weight over the course of the trial compared with those who showed less weight suppression initially. Furthermore, the Time (quadratic) x Weight Suppression interaction also reached significance. Overall, these results suggest that, as opposed to typical situations in which it is difficult for individuals at a suppressed weight to continue to lose weight, Wellspring staff members are able to continue to lose weight even when entering the program at a weight that is lower than their highest weight.

4. 4.1.3. **Weight loss goals.** A final variable of interest includes individual’s weight management goals. At the end of the summer, participants were asked how much weight they had hoped to lose over the following six weeks. Choices included losing more than 10 pounds, losing between three and 10 pounds, maintaining
current weight, gaining between three and 10 pounds, and gaining more than 10 pounds. Very few Wellspring participants indicated that they wished to gain weight (n = 6). As a result, we chose to categorize individuals into two groups for analyses – those who wished to lose weight (n = 47) and those who wished to gain or maintain weight (n = 40).

We were interested in the degree to which participants were successful in their weight management goals after participating as a leader in the Wellspring program. Results from this investigation indicate that, overall, individuals with higher BMI levels were more likely to endorse weight loss as a goal. Furthermore, a Time x Goal interaction emerged such that individuals who wished to lose weight after participating in the Wellspring program showed more resistance to weight gain than those who reported wishing to maintain or gain weight after participation in the Wellspring program.

Due to time constraints on Time 1 surveys, we did not evaluate weight loss goals at the beginning of the summer; thus, we are unable to evaluate whether individuals were successful with their weight loss goals during camp. Overall, these findings are encouraging, indicating that participants are able to manage their weight effectively.

4.4.2. Do changes in dietary restraint mediate the relationship between Wellspring participation and weight loss?

Another variable of interest in this trial included dietary restraint, as measured by the restraint subscale of the TFEQ (see Table 10 for outcomes). Notably there was a group effect for this variable, indicating that individuals in the
Wellspring group evidenced, overall, greater levels of dietary restraint than those in the comparison group. This difference was evident at baseline, $t (1, 221) = 2.02, p < .05$, and persisted throughout the trial.

Furthermore, a Time x Group interaction emerged from Time 1 to Time 2. While those in the comparison group evidenced declining dietary restraint from Time 1 to Time 2, Wellspring participants displayed the opposite pattern. When Time 3 was entered into the model, the gender and group effects persisted, and the Group x Time (linear) interaction bordered on significance. The quadratic effect of Time and the Time (quadratic) x Group effect both failed to improve the fit of the model. Altogether, the finding that dietary restraint increased in the Wellspring condition from Time 1 to Time 2 suggests that Wellspring participation contributes to changes in participants’ cognitions and dieting practices.

Theoretically, the effect of Wellspring participation on Body Mass Index should be mediated by increases in dietary restraint. That is, Wellspring participation should produce an increased awareness of caloric content, and this increase in dietary restraint should relate to BMI shifts over the course of the trial. In order to investigate this hypothesis, we examined four criteria, outlined in the Analyses section. In our initial evaluation, we have satisfied Criteria 1: Wellspring participation relates to changes in Body Mass Index, along with Criteria 2: Wellspring participation relates to changes in Dietary Restraint. An illustration of Wellspring and Comparison groups’ levels of restraint and BMI over time is provided in Figure 4.
To evaluate the third and fourth criteria for mediation, that is, that change in the hypothesized mediator produces change in the outcome in the intervention condition and that the relationship between the predictor variable and outcome is diminished after accounting for change in the mediator, we utilized Preacher and Hayes (2004) method of evaluating mediation. In this analysis, group participation was indicated as a predictor variable, with Time 2 BMI as the primary outcome variable. We evaluated mediation only from Time 1 to Time 2 in our sample, as we were interested in evaluating potential mediation of change in BMI during the time when individuals were actively participating as Wellspring staff members. Time 2 dietary restraint was evaluated as the potential mediator. Time 1 dietary restraint along with Time 1 BMI were entered as covariates in the analyses.

Mediation analyses were completed with the PROCESS procedure for SPSS (Beta Release 140712). Findings resulted in significant direct, indirect, and total effects, partially supporting a meditational model (see Figure 5). Notably, while a bootstrapping procedure with 10,000 samples produced a 95% confidence interval indicating that increases in restraint were responsible for producing BMI decreases for those in the Wellspring group, dietary restraint represented only a small portion (9.4%) of the total effect of Group membership on BMI change.
Chapter 5 – Discussion

Altogether, this study provides promising evidence for the utilization of a very low-fat diet and emphasis on high levels of activities with a wide range of individuals. Wellspring staff members did not evidence increases in eating disorder risk, disinhibition, body image disturbance, binge eating, or use of compensatory behaviors from the beginning to the end of the summer. Quite the contrary, some of these indicators actually decreased over time. Wellspring staff members did, however, show increases in dietary restraint coupled with weight loss. Furthermore, weight loss was associated with initial BMI during the summer, in that those who lost weight tended to be those who were initially overweight whereas those at initially healthy weights did not lose weight. Increases in dietary restraint, as expected, partially mediated the relationship between Wellspring participation and weight loss.

5. 1. Eating Disorder Risk

Overall, findings from this study were encouraging. First, both the Wellspring and Comparison groups evidenced reductions in key eating disorder outcome variables over time – including disinhibition and binge eating. Several reasons may exist for the shared Time effect for all participants. For instance, individuals may have experienced a demand effect from participation in the study. Individuals may have reported fewer incidents of problematic eating behavior at repeated measurements due to believing that participation in the study should have produced a shift in their eating behaviors. Furthermore, it is possible that increased awareness of one’s eating habits may have produced shifts in behavior patterns in
both groups. An alternative explanation includes the fact that many individuals in this study were college-aged, and may have very different health habits during the summer than at other times during the year. Change in environment, diet, and activity levels could be relevant to both the Wellspring and Comparison group, leading to decreased eating pathology in both groups. Regardless of explanation, the finding suggests that Wellspring participation produced no negative effects on eating disorder risk.

5.2. Weight Management

With regards to obesity risk, a clear picture emerged favoring those in the Wellspring condition. Overall, individuals in this condition reduced their BMI, while those in the comparison condition did not evidence a reduction in BMI. Furthermore, the finding that individuals in the Wellspring condition lost weight was supported through objective weight and height measurements – indicating that their reported weight loss was not due simply to demand characteristics. In fact, the average reduction in BMI through weight and height measurements was greater than average self-reported reduction in BMI for Wellspring participants. An examination of objective and self-report BMI of Wellspring participants indicates that individuals in this condition were likely to underestimate their weight at Time 1 by an average of about one pound ($M = .91$ pounds, $SD = 3.88$; $t (94) = 2.25$, $p = .03$); however, they produced more accurate estimates at Time 2 ($M = .22$ pounds, $SD = 4.54$; $t (72) = -.42$, $p = .67$), possibly due to an increased awareness of their body weight from the measurement at Time 1 or an increased tendency to weigh oneself during the summer.
Another important finding with regards to weight trajectory includes individual differences in weight loss over the course of the summer. While the Wellspring program is designed as a weight loss intervention, not all individuals should experience significant weight loss over the summer. The Wellspring program would be considered successful if individual difference variables, including initial BMI, moderated the relationship between Wellspring participation and weight loss. In this trial, individuals with lower BMI levels at the beginning of the summer evidenced less weight loss as compared to those who began the summer at a higher BMI. This finding is important as it suggests that individuals are successful at managing their weight in a way that promotes appropriate healthy weight management at a wide range of initial BMI levels.

An additional moderator that included weight loss goals at the end of the summer, and individuals who had participated in the Wellspring program and stated that they would like to lose weight evidenced more resistance to weight gain in the six-week period following camp as compared to individuals who stated that they would like to maintain or gain weight. Overall, weight management findings for leaders in the Wellspring program were encouraging. Individuals lost weight, reducing their risk of obesity. Furthermore, individuals managed their weight appropriately based on their individuals needs and goals. Wellspring participants demonstrated efficacy in weight regulation both during and after participation in the Wellspring program, and they did so to a greater degree than comparison participants.
5. 3. Dietary Restraint

Variables such as weight suppression and dietary restraint are typically coupled with weight gain over time in community studies (Lowe et al., 2006b; Neumark-Sztainer, Wall, Eisenberg, Story, & Hannan, 2006; Stice, Cameron, Killen, Hayward, & Taylor, 1999; ). Despite this finding, several controlled trials in recent years have found that dieting does not universally promote negative outcomes, and interventions that promote healthy weight management have proven successful in reducing risk for overweight and obesity in a wide range of individuals (Burton & Stice, 2006; Butryn et al., 2007; Gierut, Pecora, & Kirschenbaum, 2012; Stice, Trost, & Chase, 2003).

Interestingly, Wellspring participants entered the study with higher levels of dietary restraint than comparison participants. This finding could relate to several factors. First, Wellspring and Comparison participants were not randomly assigned, and individuals who were motivated to work at a weight loss summer camp may have had a past history of engaging in dietary restraint. In support of this hypothesis, individuals in the Wellspring group also evidenced a higher level of weight suppression at baseline. Thus, these participants had successfully lost weight and maintained weight loss to a greater degree than comparison participants prior to starting camp. Notably, several staff members (n = 20) had participated as a Wellspring staff member in a prior summer. Furthermore, a few staff members (n = 6) had previously been campers or students at a Wellspring camp or school.

In this investigation, we expected dietary restraint to increase over the course of the summer for those in the Wellspring intervention. In accordance with
our hypotheses, dietary restraint increased in the Wellspring group over the course of the summer, while it did not increase in the comparison group. This finding occurred despite the fact that these individuals entered the study at a higher level of dietary restraint, increasing the difference between Wellspring and Comparison participants on this variable over the course of the trial. The finding that dietary restraint increased while other measures of eating pathology did not speaks to the safety of structured dieting interventions in healthy weight individuals. It appears that Wellspring staff members are able to eat a low-fat diet while tailoring their caloric intake to meet their weight management goals.

Finally, the effect of Wellspring participation on weight loss was partially mediated by increases in dietary restraint, indicating that restraint provided a measure of effective weight management in this population. This particular finding is in contrast to other longitudinal and cross-sectional studies, which suggest that dietary restraint relates to high BMI and weight gain over time. One hypothesis regarding this finding includes that structured dieting programs are more likely to produce effective self-regulation and dietary restraint efforts, while naturalistic restraint may include unsustainable strategies for weight loss that promote long-term weight gain.

5. 4. Limitations

While results from this study suggest that practicing a low-fat diet may be safe for a range of individuals, several limitations should be noted. First, the Wellspring and Comparison participants were not randomly assigned, leading to a couple of key between group differences at baseline, including the fact that
Wellspring participants evidenced higher levels of dietary restraint and weight suppression than comparison participants at the beginning of the trial. As groups were not randomly assigned, causal inferences can also not be made from this investigation.

An additional limitation to this trial includes the frequency of evaluation. Measurements were taken at the beginning and end of summer, and more frequent evaluations would elucidate the relationship between participation as a Wellspring leader and risk over time. It is possible that fluctuation in weight and eating patterns occurred throughout the summer but remain undocumented in this study. Furthermore, more frequent evaluations would strengthen the ability to assess mediation in this trial, as a temporal relationship between change in hypothesized mediators and change in outcome variables could then be established.

Finally, while we evaluated several key variables in this study, the measurements here did not provide an exhaustive account of potential impacts on eating disorder and obesity risk. Additional measures of adiposity such as body measurements and body fat percentage would enhance BMI findings, and additional eating disorder questionnaires and interviews would provide more detailed information about the relationship between participation as a Wellspring leader, dietary restraint, and eating disorder risk.

While many of these suggestions would bolster conclusions from this study, important concerns inhibited our ability to fully address these limitations. First, this investigation was a collaborative project in partnership with an external organization. Evaluating the outcomes of a variety of individuals in such
organizations is an important endeavor, as findings can inform the practices of such organizations (Shoultz et al., 2006). In addition, collaborations such as this allow for the investigation of unique research questions. In the current trial, the examination of healthy individuals who were voluntarily adhering to a very low-fat diet provided an interesting sample. Relatively little research had previously investigated the effects of such a program on healthy individuals.

In order to develop a relationship with an external organization, the needs of this community or organization should be considered (Becker, Stice, Shaw, & Woda, 2009; Kendall, 2002; Shoultz et al., 2006). In the current study, performing lengthy assessments and random assignment would not have been feasible given the camp setting. For the same reason, frequent and invasive assessments were not available in this study. Most importantly, considering the needs and desires of the organization was paramount to engaging in successful collaborative research on a unique population, in this case healthy individuals in a restricted food environment.

**Conclusions**

The current study sought to extend findings from such investigations in a setting that shifts the dietary intake of healthy-weight individuals. The purpose of this research was several-fold, including to evaluate the safety and efficacy of participation as a leader in a weight loss summer camp for healthy weight individuals, and to utilize this population as an analogue for other healthy populations who practice a structured, low-fat diet.

Healthy individuals might be motivated to follow such a dietary approach for several reasons. For instance, families may choose to follow a low-fat diet together
in order to assist with the weight management plan of specific family members. Healthy weight individuals may also choose to follow a low-fat diet for the purposes of obesity prevention, and previously overweight individuals may follow such a diet in order to prevent weight regain. Thus, the evaluation of a structured dieting intervention in healthy individuals has both theoretical and practical implications.

A secondary aim of the current study involved examining the weight trajectory of individuals who participated as leaders in the Wellspring program to evaluate whether participation in the program was associated with weight loss, along with whether any changes that occurred as a result of Wellspring participation persisted into the follow-up period, six weeks later. Finally, we sought to examine whether individual difference variables moderated response to the Wellspring program and, if changes occurred, whether hypothesized mediators were responsible for inciting shifts in outcome variables.

Altogether, this study provides promising evidence for the utilization of a low-fat diet with a wide range of individuals. Wellspring staff members did not evidence increases in eating disorder risk, disinhibition, body image disturbance, binge eating, or use of compensatory behaviors from the beginning to the end of the summer; however, they did show increases in dietary restraint coupled with weight loss. Furthermore, weight loss was associated with initial BMI during the summer, along with Wellspring participants’ weight management goals from the end of the summer to six-week follow-up. While restraint did partially mediate the relationship between participation in the Wellspring program and weight loss, this relationship was relatively small, indicating that other variables may also be
responsible for weight loss. As the obesity epidemic increases, the utilization of interventions that promote dietary restraint in the general population may be vital for the advancement of public health.
References


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Table 1

Means and Standard Deviations for Variables of Interest

<table>
<thead>
<tr>
<th></th>
<th>TFEQ-R</th>
<th>TFEQ-D</th>
<th>Binge Eating Episodes</th>
<th>Compensatory Behaviors</th>
<th>BIDQ-Mean</th>
<th>BMI (self-report)</th>
<th>BMI (objective)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wellspring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 1</td>
<td>11.94 (4.29)</td>
<td>6.22 (3.80)</td>
<td>.64 (1.26)</td>
<td>1.85 (3.84)</td>
<td>.78 (.67)</td>
<td>22.50 (3.04)</td>
<td>23.42 (3.45)</td>
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<tr>
<td>Time 2</td>
<td>12.53 (4.01)</td>
<td>5.72 (3.58)</td>
<td>.45 (1.01)</td>
<td>1.41 (3.38)</td>
<td>.67 (.61)</td>
<td>21.96 (2.64)</td>
<td>22.73 (2.89)</td>
</tr>
<tr>
<td>Time 3</td>
<td>12.35 (4.00)</td>
<td>5.65 (3.82)</td>
<td>.59 (1.23)</td>
<td>1.19 (2.81)</td>
<td>.70 (.64)</td>
<td>22.09 (2.42)</td>
<td>--</td>
</tr>
<tr>
<td>Comparison</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 1</td>
<td>10.47 (4.57)</td>
<td>6.60 (3.61)</td>
<td>.46 (1.07)</td>
<td>1.24 (2.73)</td>
<td>.67 (.58)</td>
<td>22.67 (4.35)</td>
<td>22.43 (2.75)</td>
</tr>
<tr>
<td>Time 2</td>
<td>10.38 (4.81)</td>
<td>6.16 (3.34)</td>
<td>.45 (1.20)</td>
<td>1.12 (2.57)</td>
<td>.57 (.60)</td>
<td>22.54 (4.25)</td>
<td>22.30 (2.50)</td>
</tr>
<tr>
<td>Time 3</td>
<td>10.29 (4.59)</td>
<td>6.36 (3.90)</td>
<td>.47 (1.30)</td>
<td>1.04 (2.50)</td>
<td>.59 (.55)</td>
<td>22.45 (4.35)</td>
<td>--</td>
</tr>
</tbody>
</table>

Note. Means are reported for only those individuals who completed all time points to facilitate comparison of means across time points (Wellspring n = 81, Comparison n = 96). TFEQ-R = Three Factor Eating Questionnaire – Restraint subscale; TFEQ-D = Three Factor Eating Questionnaire – Disinhibition Subscale; Binge Eating Episodes and Compensatory Behaviors measured from self-reports on the Eating Disorder Diagnostic Scale; BIDQ-Mean = Body Image Disturbance Questionnaire – Mean Score; BMI = Body Mass Index.
### Table 2

**Data Transformations**

<table>
<thead>
<tr>
<th></th>
<th>Range</th>
<th>Mean (SD)</th>
<th>Skewness (SE)</th>
<th>Transformation</th>
<th>Mean (SD)</th>
<th>Skew (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (self-report)</td>
<td>14.25 – 32.09</td>
<td>22.35 (2.88)</td>
<td>.65 (.10)</td>
<td>Inverse</td>
<td>4.56 (.57)</td>
<td>.20 (.10)</td>
</tr>
<tr>
<td>TFEQ-R</td>
<td>0-24</td>
<td>11.223 (4.53)</td>
<td>-.12 (.10)</td>
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<td>--</td>
<td>--</td>
</tr>
<tr>
<td>TFEQ-D</td>
<td>0 - 16</td>
<td>6.09 (3.63)</td>
<td>.70 (.10)</td>
<td>Square Root</td>
<td>2.57 (.68)</td>
<td>.17 (.10)</td>
</tr>
<tr>
<td>BIDQ-Mean</td>
<td>0-3.57</td>
<td>.65 (.61)</td>
<td>1.63 (.10)</td>
<td>Inverse</td>
<td>.67 (.20)</td>
<td>.01 (.10)</td>
</tr>
<tr>
<td>Compensatory Behaviors</td>
<td>0-21</td>
<td>1.35 (3.50)</td>
<td>3.48 (.10)</td>
<td>Inverse</td>
<td>.78 (.35)</td>
<td>-1.01 (.10)</td>
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<tr>
<td>Binge Episodes</td>
<td>0-7</td>
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<td>3.15 (.10)</td>
<td>Inverse</td>
<td>.87 (.27)</td>
<td>-1.59 (.10)</td>
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<tr>
<td>Weight Suppression</td>
<td>0-126</td>
<td>13.48 (16.54)</td>
<td>3.40 (.10)</td>
<td>logarithmic</td>
<td>.95 (.47)</td>
<td>-.38 (.09)</td>
</tr>
</tbody>
</table>

Table 3
Means and Standard Deviations for Variables of Interest - Transformed

<table>
<thead>
<tr>
<th></th>
<th>TFEQ-D*</th>
<th>Binge Episodes+</th>
<th>Compensatory Behaviors+</th>
<th>BIDQ- Mean+</th>
<th>BMI (self-report)++</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wellspring</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Time 1</td>
<td>2.59 (.72)</td>
<td>.81 (.30)</td>
<td>4.21 (1.36)</td>
<td>.62 (.20)</td>
<td>4.52 (.57)</td>
</tr>
<tr>
<td>Time 2</td>
<td>2.50 (.67)</td>
<td>.86 (.26)</td>
<td>4.13 (1.37)</td>
<td>.67 (.19)</td>
<td>4.62 (.53)</td>
</tr>
<tr>
<td>Time 3</td>
<td>2.47 (.72)</td>
<td>.83 (.29)</td>
<td>4.11 (1.52)</td>
<td>.68 (.22)</td>
<td>4.58 (.53)</td>
</tr>
<tr>
<td>Comparison (n = 100)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 1</td>
<td>2.68 (.67)</td>
<td>.86 (.26)</td>
<td>3.76 (1.41)</td>
<td>.66 (.20)</td>
<td>4.48 (.57)</td>
</tr>
<tr>
<td>Time 2</td>
<td>2.60 (.64)</td>
<td>.88 (.26)</td>
<td>3.67 (1.36)</td>
<td>.68 (.19)</td>
<td>4.50 (.57)</td>
</tr>
<tr>
<td>Time 3</td>
<td>2.61 (.73)</td>
<td>.88 (.26)</td>
<td>3.61 (1.56)</td>
<td>.69 (.20)</td>
<td>4.53 (.57)</td>
</tr>
</tbody>
</table>

Note *Square-root transformation, +Inverse transformation, ++ Inverse transformation, multiplied by 100. Means and standard deviations are only presented for individuals who completed all three time points to aid in interpretation. Wellspring n = 80, Comparison n = 98. TFEQ-D = Three Factor Eating Questionnaire – Disinhibition Subscale; Binge Eating Episodes and Compensatory Behaviors measured from self-reports on the Eating Disorder Diagnostic Scale; BIDQ-Mean = Body Image Disturbance Questionnaire – Mean Score; BMI = Body Mass Index.
### Table 4
Demographic and Baseline Variables by Group

<table>
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<tr>
<th></th>
<th>Age</th>
<th>Weight Status</th>
<th>History of Dieting</th>
<th>Weight Suppression</th>
<th>BMI (T1)</th>
<th>TFEQ-R (T1)</th>
<th>Gender</th>
<th>Ethnicity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wellspring</strong></td>
<td>24.01 (4.86)</td>
<td>13.4% OW 2.1% OB</td>
<td>47.8%</td>
<td>16.10 (20.51)</td>
<td>22.56 (3.17)</td>
<td>11.94 (4.29)</td>
<td>74.3% female</td>
<td>86.6% Caucasian</td>
</tr>
<tr>
<td><strong>Comparison</strong></td>
<td>23.70 (4.93)</td>
<td>14.6% OW 2.4% OB</td>
<td>52.2%</td>
<td>11.45 (12.37)</td>
<td>22.48 (3.06)</td>
<td>10.63 (4.54)</td>
<td>81.7% female</td>
<td>85.4% Caucasian</td>
</tr>
</tbody>
</table>

*Note: Wellspring n = 97, Comparison n = 122. TFEQ-R = Three Factor Eating Questionnaire – Restraint subscale; BMI = Body Mass Index. Weight Suppression measured from difference in self-report of highest weight compared to self-report of current weight.*
Table 5

EDDS Diagnoses by Group and Time

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<th>Subclinical AN</th>
<th>AN</th>
<th>Subclinical BN</th>
<th>BN</th>
<th>Subclinical BED</th>
<th>BED</th>
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<tr>
<td><strong>Wellspring</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 1</td>
<td>81.2%</td>
<td>2.5%</td>
<td>0%</td>
<td>2.5%</td>
<td>7.5%</td>
<td>2.5%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Time 2</td>
<td>82.1%</td>
<td>3.1%</td>
<td>0%</td>
<td>4.6%</td>
<td>7.5%</td>
<td>7.5%</td>
<td>0%</td>
</tr>
<tr>
<td>Time 3</td>
<td>78.8%</td>
<td>1.2%</td>
<td>0%</td>
<td>5.0%</td>
<td>7.5%</td>
<td>2.5%</td>
<td>5.0%</td>
</tr>
<tr>
<td><strong>Comparison</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 1</td>
<td>82.8%</td>
<td>1.1%</td>
<td>0%</td>
<td>6.5%</td>
<td>4.3%</td>
<td>2.2%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Time 2</td>
<td>87.5%</td>
<td>3.1%</td>
<td>0%</td>
<td>1.0%</td>
<td>2.1%</td>
<td>1.0%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Time 3</td>
<td>86.6%</td>
<td>1%</td>
<td>0%</td>
<td>1.0%</td>
<td>4.1%</td>
<td>3.1%</td>
<td>2.1%</td>
</tr>
</tbody>
</table>

*Note: Wellspring n = 97, Comparison n = 122. TFEQ-R = Three Factor Eating Questionnaire – Restraint subscale; BMI = Body Mass Index. Weight Suppression measured from difference in self-report of highest weight compared to self-report of current weight.*
Table 6  
Effect of Time and Group on Eating Disorder Outcome Variables from Time 1 to Time 2

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Effect</th>
<th>Fixed Effects</th>
<th>Random Effects</th>
<th>Model AIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>SE b</td>
<td>95% CI</td>
</tr>
<tr>
<td>BIDQ-Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td>.03*</td>
<td>.01</td>
<td>.01,.06</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>.15*</td>
<td>.03</td>
<td>-.21,-.10</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>.00</td>
<td>.01</td>
<td>-.02,.03</td>
</tr>
<tr>
<td></td>
<td>Time x Group</td>
<td>.00</td>
<td>.01</td>
<td>-.02,.02</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Binge Episodes</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>Time</td>
<td>.03</td>
<td>.02</td>
<td>-.002,.06</td>
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<tr>
<td></td>
<td>Gender</td>
<td>-.10*</td>
<td>.04</td>
<td>-.17,-.03</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>-.03</td>
<td>.02</td>
<td>-.06,.01</td>
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<td></td>
<td>Time x Group</td>
<td>.01</td>
<td>.02</td>
<td>-.03,.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compensatory Behaviors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td>.04</td>
<td>.02</td>
<td>-.004,.08</td>
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<tr>
<td></td>
<td>Gender</td>
<td>.13*</td>
<td>.05</td>
<td>-.24,-.04</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>-.02</td>
<td>.02</td>
<td>-.06, .03</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------</td>
<td>------</td>
<td>-----</td>
<td>-----------</td>
</tr>
<tr>
<td>Time x Group</td>
<td>.02</td>
<td>.02</td>
<td>-.03, .06</td>
<td></td>
</tr>
<tr>
<td><strong>Disinhibition</strong></td>
<td></td>
<td></td>
<td></td>
<td>.17</td>
</tr>
<tr>
<td>Time</td>
<td>-.08*</td>
<td>.03</td>
<td>-.14, -.02</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.28*</td>
<td>.04</td>
<td>.09, .47</td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>-.03</td>
<td>.04</td>
<td>-.12, .06</td>
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</tr>
<tr>
<td>Time x Group</td>
<td>-.01</td>
<td>.03</td>
<td>-.07, .06</td>
<td></td>
</tr>
</tbody>
</table>

Note. Disinhibition measured by the Three Factor Eating Questionnaire – Disinhibition Subscale (square-root transformed); Binge Eating Episodes and Compensatory Behaviors measured from self-reports on the Eating Disorder Diagnostic Scale (inverse transformed); BIDQ-Mean = Body Image Disturbance Questionnaire – Mean Score; Model (inverse transformed). AIC = Akaike Information Criterion. *p < .05
Table 7.
Main effects and interactions for eating disorder outcome variables from Time 1 to Time 3

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Effect</th>
<th>Fixed Effects</th>
<th>Random Effects</th>
<th>Model AIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>SE b</td>
<td>95% CI</td>
</tr>
<tr>
<td>BIDQ</td>
<td>Time (linear)</td>
<td>.04*</td>
<td>.02</td>
<td>.01, .09</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>-.14*</td>
<td>.03</td>
<td>-.20, -.09</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>-.01</td>
<td>.01</td>
<td>-.02, .03</td>
</tr>
<tr>
<td></td>
<td>Time (quadratic)</td>
<td>-.01</td>
<td>.01</td>
<td>-.03, .00</td>
</tr>
<tr>
<td></td>
<td>Time (linear) x Group</td>
<td>.01</td>
<td>.01</td>
<td>-.01, .02</td>
</tr>
<tr>
<td>Binge Episodes</td>
<td></td>
<td>.004*</td>
<td>.05</td>
<td>.001, .11</td>
</tr>
<tr>
<td></td>
<td>Time (linear)</td>
<td>.05*</td>
<td>.03</td>
<td>.001, .11</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>-.10*</td>
<td>.04</td>
<td>-.17, -.02</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>-.02</td>
<td>.02</td>
<td>-.05, .01</td>
</tr>
<tr>
<td></td>
<td>Time (quadratic)</td>
<td>-.02*</td>
<td>.01</td>
<td>-.05, .001</td>
</tr>
<tr>
<td></td>
<td>Time (linear) x Group</td>
<td>.00</td>
<td>.01</td>
<td>-.02, .02</td>
</tr>
<tr>
<td>Compensatory</td>
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<td>.005</td>
<td>.08</td>
<td>.02, .008</td>
</tr>
<tr>
<td>Behaviors</td>
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<td>.005</td>
<td>.08</td>
<td>.02, .008</td>
</tr>
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</tr>
<tr>
<td>------------------</td>
<td>---------</td>
<td>---------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>Time (linear)</td>
<td>.02</td>
<td>.01</td>
<td>-.02, .13</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-.15*</td>
<td>.05</td>
<td>-.24, -.06</td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>-.01</td>
<td>.02</td>
<td>-.04, .05</td>
<td></td>
</tr>
<tr>
<td>Time (quadratic)</td>
<td>-.02</td>
<td>.02</td>
<td>-.05, .02</td>
<td></td>
</tr>
<tr>
<td>Time (linear) x Group</td>
<td>.00</td>
<td>.01</td>
<td>-.02, .02</td>
<td></td>
</tr>
<tr>
<td>Disinhibition</td>
<td>.01</td>
<td>.33*</td>
<td>874.46</td>
<td></td>
</tr>
<tr>
<td>Time (linear)</td>
<td>-.14*</td>
<td>.06</td>
<td>-.25, -.02</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>.28*</td>
<td>.10</td>
<td>.09, .48</td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>-.03</td>
<td>.04</td>
<td>-.05, .12</td>
<td></td>
</tr>
<tr>
<td>Time (quadratic)</td>
<td>.05</td>
<td>.03</td>
<td>-.01, .10</td>
<td></td>
</tr>
<tr>
<td>Time (linear) x Group</td>
<td>-.02</td>
<td>.02</td>
<td>.02, .05</td>
<td></td>
</tr>
</tbody>
</table>

*Note. Disinhibition measured by the Three Factor Eating Questionnaire – Disinhibition Subscale (square-root transformed); Binge Eating Episodes and Compensatory Behaviors measured from self-reports on the Eating Disorder Diagnostic Scale (inverse transformed); BIDQ-Mean = Body Image Disturbance Questionnaire – Mean Score (inverse transformed); Model AIC = Akaike Information Criterion; *p < .05.*
### Table 8

*Main effects and interactions of predictor variables on BMI (Inverse)*

<table>
<thead>
<tr>
<th>Model</th>
<th>Effect</th>
<th>Fixed Effects</th>
<th>Random Effects</th>
<th>Model AIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>SE b</td>
<td>95% CI</td>
</tr>
<tr>
<td>Time 1 – Time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td></td>
<td>.05*</td>
<td>.01</td>
<td>.02, .08</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td>.20*</td>
<td>.09</td>
<td>.02, .38</td>
</tr>
<tr>
<td>Group</td>
<td></td>
<td>-.01</td>
<td>.04</td>
<td>-.09, .06</td>
</tr>
<tr>
<td>Time x Group</td>
<td></td>
<td>.05*</td>
<td>.01</td>
<td>.02, .07</td>
</tr>
<tr>
<td>Time 1 – Time 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time (linear)</td>
<td></td>
<td>.08</td>
<td>.02</td>
<td>.04, .13</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td>.24</td>
<td>.09</td>
<td>.08, .44</td>
</tr>
<tr>
<td>Group</td>
<td></td>
<td>-.01</td>
<td>.04</td>
<td>-.09, .06</td>
</tr>
<tr>
<td>Time (quadratic)</td>
<td></td>
<td>-.03*</td>
<td>.01</td>
<td>-.05, -.01</td>
</tr>
<tr>
<td>Time (linear) x Group</td>
<td></td>
<td>.08*</td>
<td>.02</td>
<td>.03, .12</td>
</tr>
<tr>
<td>Time (quadratic) x Group</td>
<td></td>
<td>-.03*</td>
<td>.01</td>
<td>-.06, -.01</td>
</tr>
</tbody>
</table>

Note. Model AIC = Akaike Information Criterion; Initial BMI = self-reported Body Mass Index at Time 1; *p < .05
Table 9
An examination of potential predictors of BMI (Inverse) for Wellspring Participants

<table>
<thead>
<tr>
<th>Hypothesized Predictor</th>
<th>Effect</th>
<th>Fixed Effects</th>
<th>Random Effects</th>
<th>Model AIC</th>
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<tr>
<td></td>
<td></td>
<td>B</td>
<td>SE b</td>
<td>95% CI</td>
</tr>
<tr>
<td>Initial BMI</td>
<td>Time</td>
<td>.16*</td>
<td>.03</td>
<td>.10, .22</td>
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<tr>
<td></td>
<td>Time (quadratic)</td>
<td>-.07*</td>
<td>.02</td>
<td>-.20, -.04</td>
</tr>
<tr>
<td></td>
<td>Initial BMI</td>
<td>.58*</td>
<td>.01</td>
<td>.55, .60</td>
</tr>
<tr>
<td></td>
<td>Time (linear) x Initial BMI</td>
<td>-.12*</td>
<td>.03</td>
<td>-.17, -.05</td>
</tr>
<tr>
<td></td>
<td>Time (quadratic) x Initial BMI</td>
<td>.03</td>
<td>.02</td>
<td>-.003, .06</td>
</tr>
<tr>
<td>Weight Suppression</td>
<td>Time</td>
<td>.18*</td>
<td>.04</td>
<td>.10, .25</td>
</tr>
<tr>
<td></td>
<td>Time (quadratic)</td>
<td>-.07*</td>
<td>.02</td>
<td>-.10, -.03</td>
</tr>
<tr>
<td></td>
<td>Weight Suppression</td>
<td>-.13</td>
<td>.12</td>
<td>-.36, .11</td>
</tr>
<tr>
<td></td>
<td>Time (linear) x Weight Suppression</td>
<td>-.20*</td>
<td>.08</td>
<td>-.36, -.05</td>
</tr>
<tr>
<td></td>
<td>Time (quadratic) x Weight Suppression</td>
<td>.09*</td>
<td>.04</td>
<td>.01, .16</td>
</tr>
<tr>
<td>Suppression Goals (Time 2)</td>
<td>Time</td>
<td>.04</td>
<td>.02</td>
<td>-.08, .001</td>
</tr>
<tr>
<td>----------------------------</td>
<td>------</td>
<td>-----</td>
<td>-----</td>
<td>------------</td>
</tr>
<tr>
<td>Time</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goals (Time 2)</td>
<td>.24*</td>
<td>.06</td>
<td>.11</td>
<td>.37</td>
</tr>
<tr>
<td>Time x Goals (Time 2)</td>
<td>-.07*</td>
<td>.02</td>
<td>-.11</td>
<td>-.03</td>
</tr>
</tbody>
</table>

*Note. Model AIC = Akaike Information Criterion; Initial BMI = self-reported Body Mass Index at Time 1; Weight Suppression measured from difference in self-report of highest weight compared to self-report of current weight. Goals (Time 2) measured by self-reported weight-management goals at Time 2. *p < .05*
Table 10

Main effects and interactions of predictor variables on dietary restraint

<table>
<thead>
<tr>
<th>Model</th>
<th>Effect</th>
<th>Fixed Effects</th>
<th>Random Effects</th>
<th>Model AIC</th>
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</thead>
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<tr>
<td></td>
<td>B</td>
<td>SE b</td>
<td>95% CI</td>
<td>Slope</td>
</tr>
<tr>
<td>Time 1 – Time 2</td>
<td></td>
<td></td>
<td></td>
<td>.33*</td>
</tr>
<tr>
<td></td>
<td><strong>Time</strong></td>
<td>.22</td>
<td>.22</td>
<td>-.21, .66</td>
</tr>
<tr>
<td></td>
<td><strong>Gender</strong></td>
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<td>.67</td>
<td>.90, 3.54</td>
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<td><strong>Group</strong></td>
<td>.70*</td>
<td>.29</td>
<td>.14, 1.30</td>
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<tr>
<td></td>
<td><strong>Time x Group</strong></td>
<td>.43*</td>
<td>.21</td>
<td>.02, .88</td>
</tr>
<tr>
<td>Time 1 – Time 3</td>
<td><strong>Time (linear)</strong></td>
<td>.32</td>
<td>.37</td>
<td>-.31, 1.14</td>
</tr>
<tr>
<td></td>
<td><strong>Gender</strong></td>
<td>2.36*</td>
<td>.64</td>
<td>1.10, 3.62</td>
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<td><strong>Group</strong></td>
<td>.73*</td>
<td>.29</td>
<td>.15, 1.31</td>
</tr>
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<td><strong>Time (quadratic)</strong></td>
<td>-.19</td>
<td>.17</td>
<td>-.54, .15</td>
</tr>
<tr>
<td></td>
<td><strong>Time (linear) x Group</strong></td>
<td>.70 (.05)</td>
<td>.36</td>
<td>-.01, 1.43</td>
</tr>
<tr>
<td></td>
<td><strong>Time (quadratic) x Group</strong></td>
<td>-.26</td>
<td>.17</td>
<td>-.61, .08</td>
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</tbody>
</table>

*Note.* Dietary Restraint measured by the Three Factor Eating Questionnaire – Restraint Subscale; Model AIC = Akaike Information Criterion; *p < .05
Figure 1. Hypothesized Model

- Dietary Restraint (Time 2) → Wellspring Participation
- BMI (Time 1) → Healthy Weight Management
- Weight Suppression (Time 1) → Healthy Weight Management
- Weight loss goals (Time 2) → Healthy Weight Management
- Reduced ED Risk
- Body Image Improvement
Figure 2. Participant flow through the study

<table>
<thead>
<tr>
<th>Camp Recruitment</th>
<th>N</th>
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</thead>
<tbody>
<tr>
<td>Wellspring Pennsylvania</td>
<td>20</td>
</tr>
<tr>
<td>Wellspring Florida</td>
<td>24</td>
</tr>
<tr>
<td>Wellspring Adventure Camp</td>
<td>29</td>
</tr>
<tr>
<td>Wellspring New York</td>
<td>32</td>
</tr>
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</table>

Excluded

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Left Camp 4</td>
</tr>
</tbody>
</table>

Wellspring Participants Consented (N = 108)

Survey Measures 104
Weight and Height 97

Time 1

Survey Measures 104
Weight and Height 97

Time 2

Survey Measures 96
Weight and Height 84

Time 3

Survey Measures 86

Comparison Participants Consented (N = 136)

Survey Measures 134
Weight and Height 57

Time 1

Survey Measures 134
Weight and Height 57

Time 2

Survey Measures 116
Weight and Height 37

Time 3

Survey Measures 108

Referral Source

<table>
<thead>
<tr>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wellspring Participants 127</td>
</tr>
<tr>
<td>Summer University Students 3</td>
</tr>
<tr>
<td>Traditional Summer Camps 8</td>
</tr>
</tbody>
</table>

N

Left Camp 4

Wellspring Pennsylvania 20
Wellspring Florida 24
Wellspring Adventure Camp 29
Wellspring New York 32
Figure 3. BMI from Time 1 to Time 2 by initial BMI and group. BMI = Body Mass Index. Standard errors are represented in the figure by the error bars attached to each column.
Figure 4. Dietary Restraint and Body Mass Index across time by group and initial weight status. Wellspring – Healthy Weight n = 70, Wellspring – Overweight n = 13, Comparison – Healthy Weight n = 74, Comparison Overweight n = 21. Standard errors are represented in the figure by the error bars attached to each point.
Total Effect = .051, (95% CI [0.24, .078])
Indirect Effect = .005 (95% CI [0.001, .017])

Figure 5. Mediation model. BMI = Body Mass Index, inverse transformed; Restraint measured from the Three Factor Eating Questionnaire – Restraint Subscale; *p < .05. Dietary Restraint (Time1) and BMI (Time 1) entered as covariates.