THE EFFECT OF EXERCISE, WEIGHT LOSS PROGRAMS, AND BODY COMPOSITION ON PSYCHOLOGICAL OUTCOMES

A Dissertation

by

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ABSTRACT

The purpose of this study was to analyze whether changes in weight, BMI, anthropometrics, and body composition over the course of a 10-week weight loss intervention would promote changes in psychological measures, including quality of life (SF-36), body image (MBSRQ-AS), self-esteem (RSE), and social physique anxiety (SPAS). Some 207 women (age 47.6±13.2 yrs., height 64±2.6 in, weight 203±42.1, BMI 34.7±6.4, body-fat percentage 41.5±4.4 %) were designated to either an high-protein (HP) or high-carbohydrate (HC) diet in addition to 30 minutes of circuit-based exercise three times per week for 10 weeks. Participants were initially retrospectively analyzed. Assessed at 0 and 10 weeks were weight, BMI, waist/hip ratio, fat mass, fat-free mass, and body-fat percentage parameters as well as psychometrics, including the SF-36, MBSRQ-AS, RSE, and SPAS. Data were analyzed using multiple bivariate correlations, considering both delta changes as well as percent changes from baseline to the conclusion of the intervention. Overall, as female participants lost weight and improved anthropometrics and body composition measures, subsections of both quality of life and body image significantly improved. In fact, these psychosocial improvements occurred even if no weight was lost. Specifically, there were no significant relationships between changes in weight/BMI, anthropometrics, and body composition and change scores in self-esteem or social physique anxiety. Nevertheless, the results of this study suggest there are evident psychological benefits and physiological outcomes of participating in a behavioral weight loss program. These findings positively reinforce the use of physical activity as a means of helping and empowering women with both their physical and mental health.

DEDICATION

In loving memory of Dr. Mike C. Greenwood. Any words I write here will never do you justice. Thank you for believing in me when I did not believe in myself. You taught me to embrace challenges, not to fear failure, and that there is no point in having intelligence if I cannot apply it and communicate it with people in a meaningful way. You continuously challenged me to ask myself "why" and if I didn't have a good reason, then you questioned why I was doing it in the first place. You embodied humbleness and resilience and will be an example to me for the rest of my life. You are truly missed.

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NOMENCLATURE

1RM	One Repetition Maximum
ACSM	American College of Sports Medicine
AMRAP	As Many Repetitions as Possible
ANOVA	Analysis of Variance
BF	Body Fat
BDI	Beck Depression Inventory
BIA	Bioelectrical Impedance
BMC	Bone Mineral Content
BMI	Body Mass Index
BP	Blood Pressure
BP	Bodily Pain
CDC	Center for Disease Control and Prevention
CHO	Carbohydrate
DBP	Diastolic Blood Pressure
DEXA	Dual Energy X-Ray Absorptiometry
DOMS	Delayed Onset Muscle Soreness
EKG	Electrocardiogram
ESNL	Exercise and Sport Nutrition Laboratory
FFM	Fat Free Mass
FM	Fat Mass
G	Grams
GH	General Health

HC	Higher Carbohydrate
HBM	Health Belief Model
HDL	High-Density Lipoprotein
HMB	Hydroxymethylbutyrate
HP	Higher Protein
HPA	Hypothalamic-Pituitary-Adrenal
HR	Heart Rate
HRQL	Health-Related Quality of Life
IF	Intermittent Fasting
IRB	Institutional Review Board
KCAL	Kilocalorie
LDL	Low-Density Lipoprotein
MBSRQ-AS	Multidimensional Body-Self Relations Questionnaire
MCS	Mental Health
MH	Mental Health
MHR	Maximal Heart Rate
MVPA	Moderate-to-Vigorous Physical Activity
NIH	National Institute of Health
NWCR	National Weight Control Registry
ODPHP	Office of Disease Prevention and Health Promotion
PCS	Physical Health
PDA	Personal Digital Assistant
RE	Role-Emotional

REE	Resting Energy Expenditure
PF	Physical Functioning
RP	Role-Physical
RPE	Rate of Perceived Exertion
RSE	Rosenberg Self-Esteem Scale
SBP	Systolic Blood Pressure
SCT	Social Cognitive Theory
SDT	Self-Determination Theory
SF	Social Functioning
SF-36	36-Item Short Form Health Survey
SPAS	Social Physique Anxiety Scale
TC	Total Cholesterol
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
TTM	Transtheoretical Model
VO_2	Volume of Oxygen Consumption
VT	Vitality

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CHAPTER I

INTRODUCTION

Background

Obesity, a disordered energy imbalance between energy intake and energy expenditure, is an ongoing and chronic public health problem within the United States [1]. Recent data from the Centers for Disease Control and Prevention (CDC) demonstrate that the age-adjusted prevalence of obesity amongst U.S. adults has risen from 39.8% in 2015-2016 to 42.4% in 2017-2018. While this observed change is not notably significant, the increase from 30.5% in 1999-2000 to 42.4% in 2017-2018 is statistically significant [2, 3]. Furthermore, with the growing prevalence of obesity there are also accompanying risks of both fatal and non-fatal diseases such as coronary heart disease, diabetes, stroke, osteoarthritis, and various forms of cancer [4]. In 2008, public health economists postulated the cost of all medical spending was linked to obesity to be as high as $147 billion per year [5]. Based on predictive modelling conducted in 2011, health experts hypothesized this figure could increase as much as $48-$66 billion per year [4]. The reality of such circumstances has the capacity to not only alter individuals' socioeconomic statuses but also to greatly impact both the length and quality of their lives as well as those of the proceeding generations. Therefore, if obesity provides people with diminishing physiological and psychological returns, it can be demonstrated that losing weight through diet and exercise would, therefore, ameliorate such outcomes and symptomatology.

Extensive research has examined the effects of diet and physical activity on weight loss. Physical activity is one avenue that has shown to have a modest effect on body weight, typically reducing it by 3% of initial weight loss [6]. Overwhelmingly, the evidence indicates that a hypocaloric diet in addition to physical activity produces the greatest weight loss results than either variable alone [1, 7-12]. However, adding cognitive/behavioral interventions to the process can magnify weight loss results as well as aid in the mechanism of weight maintenance [13-32]. In fact, despite not having achieved a clinically desirable 5%-10% weight loss, participants in such exercise and weight loss programs have derived psychological benefits regardless of their weight loss outcomes [33, 34].

Preliminary research suggests that a reciprocal relationship exists between changes in bodyweight and psychological factors such as body image, mood, quality of life, and subjective well-being [17, 35, 36]. Several studies have found there to be a remarkable relationship between obesity, quality of life, and depression [37-44]. Some research has even purported a dose-response relationship between weight and depressive symptoms [45-47]. Such an interaction has been found amongst depressed adolescents, particularly females, thereby forecasting their future obesity development into adulthood [48-52]. The reverse association has also been corroborated: obese, young females or female adolescents have been reported to be at an increased subsequent risk for both depression and anxiety disorders as adults [37, 53-56]. Regardless of which variable precipitates which, the overarching goal amongst health practitioners is to ultimately reduce rates of obesity and symptoms of depression as well as to increase the overall health, longevity, and well-being of people worldwide through conscientious eating and intentional physical activity.

With recent advances in medical research and technology, extensive methods of determining body composition now play an integral role in discerning fat from muscle within the body. A number of studies have incorporated various forms of body composition into their methodological assessments of diets, exercise, hypertrophy, and weight loss programs [57-67]. However, only a small number of studies included psychological variables such as quality of life, body image, self-esteem, and/or social physique anxiety [58-60, 62-66]. Notably, one of the major limitations of past and present weight loss research studies is the failure to include body composition data to truly assess whether weight loss was attributed to the loss of fat, water, or lean muscle mass [68]. Therefore, with these additional, underlying data points, it seems idiosyncratic that the emphasis of weight loss is still, in some contexts, devoid of such deeper body compositional analysis [69]. However, the costs of procuring, maintaining, and operating such equipment, as well as training the appropriate research team on its mechanistic complexities, remains an enduring obstacle [70, 71]. Nevertheless, in an American society that is obsessed with body image and weight stigma, there has yet to be a significant psychological shift from measuring the difference in the total number of pounds on the scale to understanding, reframing, and accepting the percentage of fat lost as well as the number of pounds of lean muscle mass gained [72-79].

Statement of the Problem

Rates of obesity within the United States continue to climb precipitously with limited discrimination based on age, ethnicity, or gender [2, 3]. Such an increased prevalence is not only correlated with increased medical costs, increased comorbidities, and a lower quality of life, but it is also associated with a greater risk of premature mortality [4, 5]. To combat such a dilemma, there has been no shortage of commercial diet, exercise, and weight loss programs in attempts to mitigate the outcomes of obesity [80-83]. However, the effectiveness of such interventions, particularly in terms of producing long-term weight loss as well as weight maintenance, continues to be a struggle [84]. Not only are there significant attrition rates within the studies themselves, but the rates of self-reported weight as well as dietary and exercise adherence also remain questionably biased [31, 52, 61, 68, 74, 81, 85-98]. Therefore, this begs the question: are participants physiologically unable to lose weight and maintain the loss due to an underlying mechanism or are there psychological impediments (e.g., stigma, self-efficacy, readiness, psychopathology) that ultimately influence weight outcomes and vice versa [52, 72-79, 99-102]. However, the other remaining larger issue is weight loss accounts for the loss of pounds on the scale: fat loss or muscle mass? Only more recently have weight loss studies been implementing more precise tools for body compositional analysis [58, 69, 103, 104]. Notably, the gap in the literature lies in the underutilization of specific body compositional information in regard to psychometrics (e.g., exercise initiation, adherence, motivation, self-esteem, body image, quality of life) [105].

Purpose

The purpose of this study was to determine whether there is a significant relationship between changes in physiological variables (weight/BMI, waist/hip ratio, and fat mass, fat-free mass, and fat percentage) and psychological variables (quality of life, body image, self-esteem, and social physique anxiety) in sedentary, overweight women between the ages of 18-75 years after participating in a 10-week exercise and weight loss program. The conclusions of this investigation add to the abundant body of literature on weight loss as well as various accompanying psychometrics. However, this study uniquely contributes to the understanding of changes in body composition in relation to developments of distinct psychosocial outcomes after completing a 10-week intervention. These results may serve as a better foundation for how weight loss programs may be more optimally implemented or maintained in the future, particularly as technological advances allow for greater precision of body composition analysis. In other words, if evidentiary supported psychosocial interventions occur before, during, or after weight loss programs, such results can help motivate overweight and obese women to initiate and maintain attendance in diet and weight loss programs and teach and encourage them how to manage such individualized, prescriptive weight losses once the interventions have ended, thereby increasing their self-esteem, locus of control, and overall subjective well-being [21, 22, 26, 35, 58, 106-112].

General Study Overview

This is a retrospective analysis of women aged 18-75 years who participated in one of eight 10-week weight loss programs, an investigation of the effects of dietary adherence to one of two interventions and simultaneous engagement in a circuit-training based exercise regimen. Participants who met the physician-approved criteria were invited to partake in the 10-week diet and exercise protocol. Depending on their responses to a carbohydrate tolerance questionnaire, participants were divided and allocated to a hypocaloric diet group, either higher in carbohydrate or higher in protein, and were instructed to participate in a circuit-based resistance-training program.

Assessments included anthropometry, body composition, dietary intake, resting energy expenditure, and serum clinical chemistry samples, which were measured at 0 and 10 weeks. Participants also partook in a maximal cardiopulmonary exercise stress test as well as upper and lower body muscular strength and endurance tests at each session. Quality of life and body image questionnaires were also completed at each assessment.

Hypotheses

H_1: There will be a statistically significant relationship between changes in weight/BMI and outcome measures of quality of life (SF-36).

H_2: There will be a significant relationship between changes in anthropometrics (waist/hip ratio) and outcome measures of quality of life.

H_3: There will be a significant relationship between changes in body composition (fat mass, fat-free mass, body fat percentage) and outcome measures of quality of life.

H_4: There will be a significant relationship between changes in weight/BMI and outcome measures of body image (MBSRQ-AS).

H_5: There will be a significant relationship between changes in anthropometrics and outcome measures of body image.

H_6: There will be a significant relationship between changes in body composition and outcome measures of body image.

H_7: There will be a significant relationship between changes in weight/BMI and outcome measures of self-esteem (RSE).

H_8: There will be a significant relationship between changes in anthropometrics (waist/hip ratio) and outcome measures of self-esteem.

H_9: There will be a significant relationship between changes in body composition and outcome measures of self-esteem.

H_{10}: There will be a significant relationship between changes in weight/BMI and outcome measures of social physique anxiety (SPAS).

H_{11}: There will be a significant relationship between changes in anthropometrics and outcome measures of social physique anxiety.

H_{12}: There will be a significant relationship between changes in body composition and outcome measures of social physique anxiety.

Delimitations

The restrictions of this study were as follows:

1. Adult, overweight, sedentary women between the ages of 18-75 years who also had a BMI > 27 kg/m^2 were recruited to participate in this study.
2. Participants were recruited with the use of flyers, which were distributed at doctors' offices, on local television channels, through local newspapers, on the Internet, as well as through campus mailings.
3. All familiarization sessions and testing sessions took place in the Exercise and Sport Nutrition Lab either at Baylor University or Texas A&M University.
4. Participants were assigned to either a high protein or a high carbohydrate diet, depending on their response to the Carbohydrate Tolerance Questionnaire.
5. Participants were required to have been sedentary for at least 3 months prior to the start of the study to be eligible to participate.
6. Participants were not permitted to have utilized nutritional supplements that would influence muscle mass, alter anabolic/catabolic hormone levels, or promote weight loss for at least 3 months prior to the start of each study.
7. Physician consent was required for participants who had been diagnosed with any controlled metabolic disorders.
8. Demographic information from the Body Image Questionnaire was excluded in the statistical analysis due to missing data points.

Limitations

1. Subject recruitment was limited to Baylor University and Texas A&M University as well as the surrounding Waco and College Station communities. Since recruitment was purposeful and based upon who responded to the advertisements, the results of this study may not be generalizable to the target population.
2. Only individuals who were self-motivated to respond to the advertisement took part in the program. Additionally, participants were provided with monetary compensation and incentive to complete the study. This may also influence the generalizability of the results to the target population.
3. To be in full compliance with the program, participants were required to follow the designated nutrition plan and perform the prescribed exercise circuit three times per week.
4. The nutrition and exercise programs were instructed to be completed by participants within a free-living environment.
5. The prescribed exercise regimen (Curves®) has an affiliated cost, which may have limited the sample to only those who could afford the program and, thus, affected the results.
6. Tobacco consumption was not an available variable within the database in terms of patient information.
7. Ethnicity was another variable not available within the database regarding patient demographic stratification. Nevertheless, the participants of this study comprised a varied representation of Central Texas, including African American, Caucasian, and Hispanic individuals.

8. Implicit limitations were also apparent with the laboratory equipment that was used for the collection and analysis of the data.

Assumptions

1. Participants provided honest answers when answering the initial screening questions, completing questionnaires, and logging food items throughout the study.
2. Participants adhered to the designated dietary regimen as prescribed.
3. Participants did not consume food or any other liquids, besides water, 12 hours prior to each testing session.
4. Participants refrained from physical exercise for at least 24 hours prior to each testing session.
5. Participants maximized their efforts when attempting maximal treadmill and strength tests.
6. In the case of an adverse event, appropriate staff members were notified by participants.
7. Equipment in the laboratory was properly calibrated before testing and functional throughout each session.
8. There was a normal distribution amongst the sample.
9. Variability between the groups was equal.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

Approximately two in five adults and one in five adolescents in the United States meet the criteria for being either overweight or obese [2]. Being overweight or obese has been shown to lead to numerous negative health outcomes such as diabetes, heart disease, stroke, and cancer [4, 15, 32, 37, 113-116]. Weight loss, on the other hand, has been shown to mitigate such risk factors for cardiovascular disease, including insulin resistance, diabetes, hypertension, and dyslipidemia [81, 91, 117, 118]. Research has demonstrated that the more frequently participants adhered to weight loss programs, the greater their weight loss and the greater the amelioration of anxiety and depressive symptoms [14, 16, 17, 33]. Therefore, if there are numerous benefits of engaging in weight loss programs, including a decreased risk of mortality and improved psychological well-being, it remains questionable and problematic that more people are not partaking in or failing to succeed in such weight loss programs, particularly as the rates of obesity within the United States among both adults and children continues to rise.

Prevalence of Obesity

According to the most recent statistics compiled and evaluated by the National Center for Health Statistics, it was estimated in 2017-2018 that 42.5% of U.S. adults ages 20 or older were obese, with 9.0% being severely obese, and 31.1% being overweight, according to standard BMI classification (kg/m^2) [119]. Overall, this equates to 73.6% of the United States adult population being either overweight or obese, and these rates have only been rising precipitously since first measured in the early 1960s.

The pervasiveness of excess weight has also had a significant impact upon children in adolescents. As reported in 2017-2018, 13.4% of children aged 2 to 5 years were obese, 20.3% of children aged 6 to 11 years were obese, and 21.2% of adolescents aged 12 to 19 years were classified as obese (i.e., being at or above the 95^{th} percentile on growth charts) [120].

While these are the most recent statistics, the CDC has also found specific trends related to gender, obesity classification, age, and race. When the statistics were age-adjusted, the prevalence of severe obesity in adults was not only 9.2%, but it was also higher in women than in men. Adults aged 40 to 59 had the highest prevalence of severe obesity, and obesity was found to be the most pronounced in non-Hispanic Black adults [3].

A comparison of these statistics to current public health initiatives, such as Healthy People 2030, from the Office of Disease Prevention and Health Promotion (ODPHP) within the U.S. Department of Health and Human Services, who are currently operating from obesity statistics from 2013-2016, demonstrates a bleak, perhaps unrealistic outlook for the future of obesity in both adults and adolescents. As stated, the 2030 target for the obese adult population is 36.0%, a reduction from 38.6%, and for obese children and adolescents the target is 15.5%, a reduction from 17.8% [121]. While these objectives are desirable trajectories, there continues to be underlying factors that prevent successful weight loss outcomes.

Weight Loss

Weight loss and weight maintenance remain difficult processes due to the increased availability of calorically dense foods as well as the increased presence of environmental and advertisement cues. This is further reinforced by a lack of physical activity, increased sedentary lifestyles, epigenetics, and learned and conditioned responses ingratiated into people's memory through emotion, food, mood, and hedonic impulses [122]. Most often when people are trying to lose weight, they attempt to consume fewer calories, eat less fat, and exercise more. Some other, less common strategies include skipping meals, consuming food supplements, joining a weight loss program, fasting, diet pills, water pills, and/or diuretics [123].

There are several different suggested weight loss interventions, including self-help and commercial programs that emphasize lifestyle and environmental modifications, behavioral or pharmacological mediation strategies, hospital-based curriculums, or even in some of the more extreme cases, bariatric surgery [124]. However, bariatric surgery is not a cure-all. While it does seem to be one of the singular, reliable methods of sustaining weight losses of 20% or more, such weight losses do not always result in decreased body dissatisfaction, reduced bodyweight and shape preoccupation, and diminished self-disparagement [125, 126]. In fact, environmental factors, such as lower socioeconomic status as well as pre-existing psychological conditions, can persist or even rebound after bariatric surgery, demonstrating a mediating power even more influential than genetics itself [127]. Therefore, losing weight and maintaining that weight loss is as much psychological as it is physiological.

The home environment is one in particular that can influence weight-regulating behaviors. When assessing the differences between the food and exercise environments of normal-weight individuals versus those of overweight adults, researchers found that overweight adults had more televisions, higher fat snacks, fewer fruits and vegetables, and less exercise equipment within their homes [128]. Therefore, if the goal is weight loss than the stimuli within the readily accessible environment needs to be reexamined and perhaps altered.

Physical Activity

Aerobic exercise and resistance training are integral components of both weight loss and weight maintenance. According to the American College of Sports Medicine (ACSM) and the CDC, it is recommended that adults exercise aerobically a minimum of 150 minutes per week of at a moderate-intensity while also engaging in muscle-strengthening activities that incorporate all major muscle groups at least twice per week [129]. However, only 51.6% of adults in the United States meet these aerobic activity guidelines, 29.3% meet the muscle strengthening guidelines, and only 20.6% meet both guidelines [129]. Remarkably, these guidelines are the minimal expectations for overall health and well-being. Notwithstanding, there is an evident dose-response relationship between physical activity and weight loss and weight maintenance [8, 14, 130, 131]. Increased physical activity has also been associated with greater dietary adherence as well as a lower intake of calories [132]. There has also been support for a similar relationship between the amount of physical activity and psychological mood or effect (i.e., mild-to-moderate depression) [24, 46, 47]. However, as demonstrated by the data, a significant proportion of the American adult population fails to meet minimum standards.

According to an ACSM position, < 150 minutes per week of aerobic physical activity produces minimal to no weight loss. Only with increasing amounts of aerobic physical activity, accompanied by a commensurate hypocaloric diet, will produce desired weight loss outcomes. If the goal is a weight loss of 2 kg to 3 kg, then a generally healthy adult should seek to aerobically exercise 150 minutes to 225 minutes per week. If the goal is a larger weight loss of 5 kg to 7.5 kg, an individual should attempt to engage in aerobic physical activity anywhere from 225 minutes to 400 minutes per week. However, once the desired weight is attained, a continuous preservation phase of 200 minutes to 300 minutes of aerobic activity per week is required for weight maintenance after weight loss [11, 12, 133]. Even higher levels of physical activity, 450 minutes of moderately-intense activity several times per week, has been suggested for obese individuals to lose weight [134].

Not only does the amount or duration of exercise matter when attempting to lose weight but the type of exercise is, if not more, important. Resistance training alone is very unlikely to produce clinically significant weight loss, an approximate 0% to 1% range of weight loss is expected. Aerobic physical activity alone may possibly produce an expected range of 0% to 3% weight loss, but only when it is conducted in high exercise volumes. When both of the training modalities are combined, clinically significant weight loss is possible, an anticipated weight loss range of 0% to 3%, but once again, this is only accompanied by high volumes of aerobic physical activity. However, when resistance training and aerobic physical activity are utilized in addition to a calorically restricted diet, the chances of clinically significant weight loss increase to an expected range of 5% to 15% of initial body weight [11, 12]. Therefore, there is a strong rationale for the implementation of both diet and exercise in weight loss and weight maintenance programs.

Nutrition

Although there are numerous ways to gain and lose weight through various diet strategies and nutritional interventions, research suggests that some approaches are more advantageous and maintainable than others. Most people try to lose weight by reducing caloric intake or increasing levels of physical activity or both simultaneously [135]. Adults tend to believe their knowledge of nutrition and physiology is high or sufficient enough to help them achieve their desired weight loss goals. This is known as having a strong perception of self-efficacy [136]. Therefore, this misconception perhaps explains why weight loss and weight maintenance continue to be difficult processes for a majority of adults and rates of being overweight and obese continue to unyieldingly climb.

Macronutrient composition is one factor that significantly influences caloric density and satiety. Established research has demonstrated that the energy content of carbohydrate is 4.1 kilocalorie (kcal)/gram (g), fat is 9.1 kcal/g, and protein is 4.3 kcal/g [137]. According to a 10-year observational study by the National Weight Control Registry (NWCR), successful weight losers on average tended to keep their calorie consumption to around 1,400 kcal/day. When leisure-time physical activity, frequency of self-weighing, and dietary restraint decreased in conjunction with an increased percentage of daily caloric consumption from fat, greater incidences of weight gain would occur [138]. This process is also known as weight cycling, which is commonly associated with decreased perception of health and well-being, specifically eating self-efficacy [90]. Weight cycling poses an increased risk for weight gain and/or regain and can undermine self-efficacy [139].

Much of the data also suggests that fat reduction within the diet is essential for obesity prevention and reversal. This is even considered an essential suggestion for primary care practitioners to their patients [124]. When fat is reduced within an individual's diet, ranging from 30% to 40% of calories per day versus 25% to 30% of calories per day, these alterations produce significantly higher weight losses in both normal-weight and overweight subjects [114]. Such a result was found to be evident in participants within a diabetes prevention program. Greater adherence to a low-fat diet not only increased dietary restraint but also increased participants' self-efficacy, leading to more effective long-term weight loss outcomes [32].

Therefore, individuals seeking to lose weight should not only reduce their overall fat intake, but also reduce sugary-rich beverages and instead obtain their carbohydrates through whole-fibrous grains, fruits, and vegetables. While few interventions have specifically analyzed fruit and vegetable consumption, increasing consumption of these food types is a particularly advantageous weight management strategy [140].

Diets that are high in protein not only prevent a negative nitrogen balance, but they also aid in maintaining lean body mass and resting energy expenditure. Additionally, proteins not only aid in the suppression of food intake more than either carbohydrates or fats, but they also help with satiety more than either macronutrient [141]. When combined with high-intensity aerobic activity and resistance training, the evidence demonstrates significant reductions in body fat percentage, abdominal fat, total cholesterol (TC), low-density lipoprotein (LDL), and systolic blood pressure (SBP) [57].

However, there is some debate that regardless of the type of dietary intervention, adherence to such a program matters more than the nutritional composition of the program itself [142]. This has been shown to be the case in a 1-year multicenter, randomized controlled trial. Even though the results suggest that a lower carbohydrate diet produces greater initial weight losses at month 3 and month 6, these results did not differ from those of the conventional diet at month 12. Both groups experienced significantly decreased diastolic blood pressure (DBP) and insulin response during an oral glucose load [91]. Upon further scrutinization of insulin secretion as well as genotype patterns, researchers found similar results when comparing a healthy low-fat diet to a healthy low-carbohydrate diet. There were no significant differences in weight loss between the dietary groups, and there was no genotype pattern or insulin secretion baseline that was correlated with dietary effects [143].

Intermittent fasting (IF) is another nutritional intervention strategy that has caught significant media attention. IF can have different methods and variations, however, most often it tends to involve severe caloric restriction (75% to 90% of caloric intake) on 1 or 2 days per week [144]. Some evidence has shown that IF can be as effective as continuous energy restriction in terms of weight loss. In fact, a 24-week randomized clinical trial demonstrated that obese women engaging in IF can reduce their body fat by up to 7%, which was also accompanied by decreased concentrations of LDL cholesterol as well as triglyceride concentrations [145]. The general concept of fasting promotes alterations in hormone secretions, metabolic pathways, and cellular response to promote greater insulin sensitivity and reduce blood pressure, glucose, inflammation, atherogenic lipids, and body fat [146].

Self-Monitoring Strategies

Dietary adherence is an essential component to successful weight loss and weight maintenance. Such consistency can only be maintained through regular monitoring either externally by researchers or internally through self-monitoring. If, however, individuals take such personal accountability, they are therefore demonstrating greater autonomous motivation over their weight loss processes. According to the NWCR, which is a large sample of successful weight losers, 3003 participants had lost 30 pounds or more and were successful in keeping it off for at least 1 year. The percentage of participants within this particular sample that reported as having weighed themselves at least once per day was 36.2%; in fact, the more frequently individuals weighed themselves the lower their BMIs and the higher their scores on cognitive restraint and disinhibition [147]. It was suggested that frequent weighing allows individuals to intervene before significant weight gains occur. Weighing infrequency is, in fact, independently associated with greater weight gain [75, 88, 148]. Furthermore, increased self-monitoring compliance has also been positively related to greater reductions in body image dysphoria [149]. In other words, improvements in self-efficacy during a theory-based structured weight loss program were associated with greater self-monitoring activities [115]. Therefore, while some individuals expressed concerns and demonstrated discomfort at being weighed regularly, scale avoidance should be addressed with individuals ahead of intervention and reinforced with corroborating evidence of the viable benefits [150].

Technology, in particular, can help aid in this self-monitoring process. Instead of utilizing a pen and paper record, personal digital assistants (PDA) and cellphone applications can bring greater accessibility and ease to this process. In fact, some research has demonstrated that utilizing a PDA increases self-monitoring adherence, and providing feedback to the participants within such software can also increase weight loss outcomes [151].

Stigma

While it is often conjectured that beauty is in the eye of the beholder, American society has often equated thinness in females with sexual attractiveness. Consequently, body size and body image have led to several preoccupations and concerns for people who do not possess the required "ideal" body type. This has led to negative social and personal consequences for individuals, particularly females, seeking to be valued and validated for their level of attractiveness [73].

Overweight and obese people who have greater weight loss biases have higher attrition rates within weight loss programs, less overall weight loss, greater caloric intake, lower rates of exercise and energy expenditure, and inconsistent patterns of self-monitoring [74, 75, 102]. If such people perceived themselves as being overweight, they not only had increased levels of metabolic functioning and increased depressive symptoms, but also their weight classification predicted a longitudinal decline in their overall subjective health and well-being [99]. Specific evidence demonstrates that weight stigma is significantly related to measures of cortisol as well as oxidative stress [77, 79]. Therefore, increased weight stigma likely drives weight gain and poorer health outcomes [78]. To combat such results, it has been suggested that a paradigm shift might be in order and not just from those who are considered overweight and obese. Weight stigma, when exercised by “normal” weighing individuals and health care practitioners towards overweight and obese individuals, contributes to lower self-esteem, eating disorders, food and body preoccupation, repeated cycles of weight loss and gain, and other health decrements in overweight and obese individuals [72]. If, on the other hand, self-restrained overweight and obese individuals are able to shift their identity more towards a liberated, forward-thinking perspective and a greater internal locus of control, then they experience greater emotional regulation, improved social interactions, better dietary habits, and more positive self-appraisal [76, 100].

While there have been suggestions for a more holistic and reciprocal approach where women can better process positive sources of information and reject negative sources of information through positive body evaluation, a model has yet to be implemented. It has been purported that to encourage this positive body evaluation on an individual basis, women need to take care of their own health, mentor others to love their bodies, and to surround themselves with like-minded individuals who promote body acceptance [152].

Predictors, Criterions, & the Hypothalamic-Pituitary-Adrenal Axis

Stress, hormones, and eating patterns are the basis of weight loss, weight gain, and weight management. According to research, chronic stress, unsuccessful dieting interventions, and their independent, yet possibly synergistic influence upon increasing the reward value of highly palatable foods, have created the perfect storm for obesity [127, 153]. Through the repeated stimulation of the hypothalamic-pituitary-adrenal (HPA) axis, thereby increasing glucocorticoid exposure, it has been purported that the HPA axis not only predicts the appropriate stress response, resulting in the development of visceral obesity, but also mediates the endocrine regulation of appetite [153, 154]. Prolonged stimulation of the HPA axis is accompanied by a ceaseless degradation of regulatory mechanisms, including feedback control as well as inhibited growth and sex steroid hormones, thereby suggesting activation of the sympathetic nervous system and further perturbation of insulin resistance and the accumulation of visceral body fat [155]. This mechanism is highly complex and not entirely understood. It has been conjectured that the pattern in which cortisol is secreted may be just as important if not more important than the total amount of cortisol secreted [156].

With those circumstances being considered, the degree of sensitivity to environmental stressors is incredibly varied and individualized. Some individuals may possess sufficient coping mechanisms to combat environmental stressors, whereas others will not [155]. What research has shown is that a “non-stressed” HPA axis has increased the variance of cortisol, particularly due to a wide circadian variation. Such results suggest increased glucocorticoid sensitivity at the level of target tissues, including both the cardiovascular system and/or visceral fat [157]. These findings have been corroborated by research that assessed binge eating disorder among obese women after a cold pressor stress test. Effectively, the binge eating disorder group had higher levels of depression as well as greater desires to binge eat after the intervention [158, 159].

Such outcomes give rise to the question of whether varying degrees of psychopathology predict obesity or whether particular stages of obesity drive symptoms of depression and anxiety. There is also the possibility that the relationship between each variable is reciprocal in nature, meaning they mutually influence one another. When healthy premenopausal and postmenopausal women were evaluated, both their stress hormones and adiponectin were measured, it was found that having a depressive disorder was related to lower adiponectin levels, which is closely associated with obesity, diabetes, and insulin resistance [160]. Furthermore, the obesity epidemic may be aggravated by the prevalence of stress, which begets the feed forward process of stress eating, thereby driving an unsatiated feedback loop of palatable foods and endogenous opioids [153, 161].

Animal studies in rats have demonstrated that an increased expression of glucocorticoid action is associated with hyperglycemia, insulin resistance, and obesity [162]. These increased levels of glucocorticoids and their resulting truncal obesity can only be reversed with conservative measures, such as decreased food intake or an increase in energy expenditure, or extreme measures such as an adrenalectomy [163]. While adrenalectomies have found popularity within experimental rat studies, the results appear to be conflicting when the rats consume a higher fat diet [164]. Furthermore, glucocorticoid supplementation in adrenalectomized rats inhibited the effects of leptin and ultimately led to leptin resistance, thereby increasing body weight [165]. Additionally, it has been purported that fasting is a more effective method of reducing transport of leptin into the rat brain [166]. There is limited evidence of the effect of adrenalectomies on weight loss, specifically with humans. This is by no means a suggested therapy for weight loss. While animal studies aid in illuminating some of the potential underlying processes of stress and weight management in human beings, there is a lack of specific mechanistic evidence that illustrates the comprehensive schematic.

Theories

There are numerous theoretical frameworks that attempt to describe the relationship between food (over)consumption, obesity, and psychology in humans. While no single theory is held by experts as universal or all encompassing, each theory independently demonstrates some evidence of potential underlying psychosocial mechanisms in this complex behavioral process.

***Health Belief Model* (*HBM*)**

Although the exact origins of the Health Belief Model (HBM) remain unknown, what is well understood is that it was established by a group of investigators in the Public Health Service between 1950 and 1960 who operated from the context of disease prevention as opposed to treatment of disease itself [167]. While these prospects have debatably swapped in the 21st century, what distinguishes this theoretical model from others is that it highlights an individual's belief of perceived susceptibility to as well as perceived threat of the disease. Furthermore, the model is reinforced by specific health motivation, in conjunction with perceived benefits and barriers, that an individual will volitionally act on his or her own accord or based upon various cues within the environment [168]. Limited research exists on the HBM in connection with personalized weight loss programs; however, there was some testimony to its efficacy when utilized to predict a mother's adherence to a diet regimen specifically prescribed for her overweight child [169].

Restraint Theory

To assess differences in anxiety eating behavior in normal-weighted individuals versus obese individuals, Herman and Mack (1975) developed a psychosomatic test, which gave rise to restraint theory. While Herman and Mack's preliminary findings suggested that some individuals may eat more when anxious, there was not enough evidentiary support to corroborate the conjecture that eating helps reduce anxiety [170]. After making revisions to the Restraint Scale based on deficiencies in relation to disinhibition, applicability to obese populations, and the scale itself, what the researchers later found was that dietary restraint was a significantly better predictor than relative body weight of weight fluctuations in the naturalistic environment [171, 172]. Although this theory provides some foundational basis, self-restraint is also assessed both directly and indirectly in other theoretical frameworks with greater degrees of application.

Self-Determination Theory (SDT) & Self-Efficacy

Self-determination theory (SDT), derived by Ryan and Deci, offers a unique approach to people's innate growth and inherent psychological needs that serve as a bedrock for personal motivation and an aid in the assimilation of one's personality [173]. Amotivation is simply the state of lacking the intention to act, whereas extrinsic motivation is the performance of an activity to obtain a separate outcome; intrinsic motivation, on the other hand, is performing an activity based upon inherent enjoyment of the task itself [173].

Studies have shown that individuals who have greater adherence to an exercise program reported greater self-efficacy, a concept coined by Bandura, particularly when overcoming barriers to exercise [174, 175]. In fact, autonomous support was found to be a better predictor of weight loss outcomes than were directive supports, which inhibited weight loss progress in one study [176]. When exercise motivation and eating self-regulation were combined during an alternative weight control intervention, increased general self-determination improved weight loss outcomes and, furthermore, regulated the relationship between physical activity and eating self-regulation [177]. Path analyses of meta-analyzed correlations have demonstrated that SDT variables comprise an applicable framework for assessing precursors and outcomes of motivation when regarding health related behaviors [178, 179]. Even different design studies of SDT, including cross-sectional, prospective, and experimental, have validated that intrinsic motivation is a significantly better predictor of long-term exercise adherence as opposed to initial or short-term adoption, which is most often motivated by identified regulation, an extrinsic source of motivation [180, 181]. More recent research suggests that SDT and self-regulation theories offer greater theoretical support for sustainable health behavior change interventions [182].

***Social Cognitive Theory* (*SCT*)**

This personal efficacy theory was formulated by Bandura; he identified four principal sources from which efficacy is derived: performance accomplishments (personal experience), physiological state, verbal persuasion, and vicarious experience. However, the source that most readily induces behavior change is mastery, resulting from effective performance [183]. What follow-up research has demonstrated is that when this theory was implemented in a behaviorally-based exercise support regimen, participants had lower dropout rates, higher attendance, and higher reported rates of exercise when compared to peers in a control group; they also had reductions in their body fat percentage, BMI, and waist circumferences as well as improved psychological factors, including total mood disturbance, physical self-concept, and body area satisfaction [13]. While these findings, integrating social cognitive theory and self-efficacy theory, only indirectly relate to body-fat and weight loss reductions, they do offer some foundational basis on which sustainable behavior change can occur [14]. This was further illustrated when path-analysis models were extended, demonstrating the effects of exercise on changes in self-efficacy, mood, self-regulation, and body image [16]. It has also been conjectured that by including observational learning and social support specifically within the exercise support regimen protocol, these factors may aid in the facilitation of greater weight loss predictions [15].

***Theory of Reasoned Action* (*TRA*) *and Theory of Planned Behavior* (*TPB*)**

The theory of reasoned action (TRA), proposed by Fishbein and Ajzen, has been a widely incorporated health model used for predicting behaviors and underlying behavioral intentions;

nevertheless, Ajzen broadened this theory in 1985, renaming it the theory of planned behavior, which identified perceived behavioral control as a precursor to behavioral intentions [184, 185]. More specifically, TRA considers the perceived social pressure to perform the behavior, the ease of performing such behavior, and the attitude specifically towards the behavior itself, while TPB regards the degree of willingness or effort an individual is willing to exert to perform a goal-directed behavior [168].

When considering women who participated in a weight-management program, researchers found that TPB constructs were more effective in predicting moderate-to-vigorous physical activity (MVPA); however, SDT was discovered to be a stronger correlate for predicting lifestyle physical activity as well as longer term activity adherence [181]. This was also to be found the case in consideration of maintenance of physical activity. While there was some predictive validity of TPB, subsequent behavior as well as perceived behavioral control of that behavior was more greatly enhanced by personal mastery, which is supported by the SCT [186]. Furthermore, having the inability to self-select levels of intensity within physical exercise caused reduced enjoyment and diminished intrinsic motivation, ultimately discouraging exercise adherence [187].

The Transtheoretical Model (*TTM*)

The transtheoretical model (TTM), also known as the Stages of Change, was developed by Prochaska and DiClemente; they purported there to be five stages of change: precontemplation, contemplation, preparation, action, and maintenance [110]. When this theory had been considered in conjunction with weight management, research has produced mixed results. One study found that the stages of change did not predict success in weight control and, in fact, supervising researchers questioned the model's classification system and its applicability across behavioral domains [188]. On the other hand, a work-site weight control program demonstrated that subjects who remained in the treatment intervention significantly shifted from the contemplation stage to the action stage [189]. More recent research has conjectured that TTM-based feedback improves multiple behaviors, including exercise, healthy eating, weight, and emotional distress management [190]. Such a model may be particularly useful in assessing participants’ readiness and/or level of commitment, but more so when it is accompanied by a skill, such as motivational interviewing, that can aid in progressing an individual from one stage to the next [191].

CHAPTER III

METHODS

Experimental Approach

This study is a retrospective analysis of preceding research that was conducted in the Exercise and Sport Nutrition Laboratory (ESNL) at Baylor University and Texas A&M University [192]. Specifically, these studies assessed whether a higher carbohydrate (HC) or a higher protein (HP) diet intervention was more effective in terms of producing weight loss outcomes, while also participating in a circuit-based resistance training program. Included in the analysis were eight studies that recruited sedentary, overweight/obese females who were generally healthy, but were also post-menopausal, osteoarthritic, and/or part of a special population. Each participant had been a part of a study that measured the effectiveness of the Curves® exercise and weight loss program (*Curves International, Waco, TX*) on weight loss and health outcomes in sedentary, overweight/obese females. This diet and exercise regimen were formulated to promote weight loss as well as improve various other markers of physical fitness [193]. For the purpose of this particular analysis, only comprehensive profiles were included (i.e., participants who completed psychosocial questionnaires SF-36, MBSRQ-AS, RSE, and SPAS at both time points as well as completed anthropometric and body composition measurements).

Table 3.1. Baseline demographics.

Study	N	Age	Height	Weight	BMI	Fat %
Overall	207	47.6±13.2	64±2.6	203±42.1	34.7±6.4	41.5±4.4

Height in inches, weight in lbs., fat percentage measured via DEXA.

Participants were designated to either an HC or an HP for a duration of 10 weeks while also participating in a supervised circuit-based resistance-training program. Primary outcome measures included SF-36 (physical health [PCS]: physical functioning [PF], role-physical [RP], bodily pain [BP], and general health [GH]; mental health [MCS]: vitality [VT], social functioning [SF], role-emotional [RE], and mental health [MH]), MBSRQ-AS subscale (appearance evaluation, appearance orientation, overweight preoccupation, body areas satisfaction scale, and self-classified weight), RSE, and SPAS [194-197]. The purpose of this analysis was to assess whether changes in weight/BMI, anthropometrics (waist/hip ratio), and body composition analysis (fat mass, fat-free mass, and body fat percentage) affect psychosocial outcomes of quality of life, body image, self-esteem, and social physique anxiety (SF-36, MBSRQ-AS, RSE, and SPAS) upon completion of a 10-week diet and exercise intervention. Specifically, each available subscale was further evaluated to assess significant variable interactions.

Participants

Before these studies were conducted, their research protocols were reviewed and approved by the Institutional Review Boards (IRBs) at Baylor University and Texas A&M University. The desired population for the purposes of this study was sedentary, overweight/obese (BMI > 27) females of the age of 18–75 years who had no recent participation in either a diet or exercise program. Participants were recruited with local advertisements, which included the local newspaper, television channels, the Internet, and campus mail. Additionally, other participants were referred by their local physician. Once initial communication had been established, potential participants were prescreened over the phone to assess eligibility. The following factors were considered contraindications for participation in the study: 1.) presence or diagnosis of any cardiovascular or metabolic disorders, including known electrolyte abnormalities (e.g., arrhythmias, heart disease, thyroid disease, diabetes, or hypogonadism); 2.)

history of musculoskeletal, hypertension, autoimmune, hepatorenal, or neurological disease; 3.) presently taking or prescribed medications for hypertension, hypoglycemia, hyperlipidemia, thyroid, and/or androgenic medications; 4.) having consumed ergogenic levels of nutritional supplements that may influence muscle mass (e.g., creatine or HMB), anabolic/catabolic hormone levels (e.g., androstenedione or dehydroepiandrosterone), or weight loss (e.g., thermogenics or ephedra) within 3 months prior to initiation of the study; and/or 5.) having been pregnant within the past year, being pregnant, or interest in becoming pregnant within the next 3 months of study commencement. Prior to being enrolled in the study, participants who had controlled metabolic disorders were required to obtain medical clearance from their primary care physicians affirming their conditions were medically controlled as well as non-influential to study results.

Once participants had passed the preliminary telephone prescreening process, eligible participants were then asked to attend a familiarization session in which they would learn more about the details of the study as well as consent, sign, and complete all of the necessary paperwork. The familiarization session consisted of the completion of personal as well as medical history forms, a written and accompanying verbal explanation of the study details, and a full description of the risks and benefits of participation. During this time, participants were also provided with an opportunity to practice training procedures as well as get familiarized with the various exercise training equipment. Participants who still met eligibility criteria and consented to the terms were then required to sign human subject informed consent statements in compliance with the Human Participants Guidelines of Baylor University and/or Texas A&M University and the ACSM. A total of 207 women participated in this study. Participants were 48

± 13 years of age, 64 ± 3 in. in height, 203 ± 42 lbs. in weight, and had a BMI of 34.7 ± 6 kg/m^2 (mean ± standard deviation).

Testing Sequence

Table 3.2 displays the general research design as well as the time course for each of the assessments [192]. Participants were tested at two different timepoints, baseline (0 weeks) and 10 weeks, during which they had completed their assigned diet and exercise protocol. Prior to each testing session, participants were asked to abstain from vigorous physical activity, the ingestion of over-the-counter medication, and any alcohol consumption for 48-hours. It was also required for participants to maintain a fasting state 12-hours prior to their scheduled appointment. Therefore, all testing was conducted in the early morning hours, starting at approximately 5:00 a.m. each day. Participants were also instructed to record the measurements of all their fluid and food intake on the provided dietary record forms for 4 days (this included 3 weekdays and 1 weekend day). These were to be submitted to researchers before every testing session.

Table 3.2. Overview of research design and testing schedule modified from "Effects of Higher Carbohydrate or Higher Protein Diets with Exercise on Individual Risk Factors of Metabolic Syndrome in Women".

Familiarization	Baseline (0 weeks)	10 weeks
Complete Paperwork	BIA[a]	BIA[a]
Dietary Assignment	Body Weight	Body Weight
Review Medical History	DEXA[b] Scan	DEXA[b] Scan
Sign Informed Consent	Diet Record Review	Diet Record Review
	Fasting Blood	Fasting Blood
	Leg Press and Bench Press Measures	Leg Press and Bench Press Measures
	Maximal Cardiopulmonary Exercise Test	Maximal Cardiopulmonary Exercise Test
	1RM[c] and 80% 1RM Isotonic	1RM[c] and 80% 1RM Isotonic
	Resting BP[d] and HR[e]	Resting BP[d] and HR[e]
	Exercise Test	Exercise Test
	Resting Energy Expenditure	Resting Energy Expenditure
	Survey Completion[f]	Survey Completion[f]
	Waist and Hip Measurements	Waist and Hip Measurements

Note: adapted from [192]

[a]Bioelectrical Impedance Analysis [b]Dual Energy X-ray Absorptiometry [c]Repetition Maximum

[d]Blood Pressure

[e]Heart Rate

[f]Standardized Quality of Life (SF-36) and Eating Satisfaction Inventory

During each testing session, participants were weighed and had the circumferences of their hip and waist measured. Body composition was tested using dual-energy x-ray absorptiometry (DEXA), while resting energy expenditure (REE) was measured, using the ParvoMedics TrueMax 2400 Metabolic Measurement System. Both blood pressure and heart rate were procured from participants while in a supine position in a rested state, using the standard procedure. Fasting blood (20 ml) was then taken from participants, using venipuncture techniques at an antecubital vein. Participants proceeded to perform a maximal cardiopulmonary exercise test as well as upper and lower body muscle strength and endurance tests. Participants were also instructed to complete questionnaires to capture their body image and quality of life at each testing session. Additionally, participants completed a weekly medical safety and side effects report, which was reviewed by the ESNL research nurse. The supervising nurse or physician monitored patients for unusual adverse effects; those who experienced such were removed from the study.

Dietary Intervention

To determine dietary group assignments, a carbohydrate/glycemic tolerance questionnaire, developed by The Institute for Nutritional Science, was administered. Individual participants who had a positive response on the questionnaire, thereby demonstrating carbohydrate (CHO) intolerance, were assigned to the HP group. Participants who had a negative response were then assigned to the HC group. Both diets were low in fat and isoenergetic. To achieve weight loss, both the HP and HC groups were encouraged to consume a hypocaloric diet of 1,200 kcal per day for 1 week (Phase I). The 9 weeks following (Phase II), participants were instructed to increase their caloric intake to 1,600 kcal per day so that they could continue to achieve a steady weight loss without negatively impacting metabolism [198]. At the commencement of the study, participants were given diet plans and menus to assist with their dietary adherence. Every 2 weeks, throughout the 10-week protocol, participants met with a registered dietician or exercise physiologist to assess dietary and exercise adherence.

Exercise Intervention

The exercise regimen was composed of three supervised 30-minute circuit-training sessions per week, for a total of 10 weeks (30 workouts). During each session, a trained exercise instructor supervised participants' proper use of the equipment. On 13 bidirectional machines, interspersed by 30-seconds of floor-based calisthenics, participants were instructed to perform as many repetitions as possible (AMRAP) within a 30-second timeframe. Within each machine, there were calibrated pneumatic resistance pistons, which allowed for concentric-only movements of opposing muscle groups. Both the machines and exercises are listed in Table 3.3 [192]. With the goal of interval training in mind, the calisthenic exercises were implemented to maintain an elevated heart rate, which equated to 60%–80% of maximal heart rate (MHR) throughout the entirety of the workout [129]. Participants were instructed to complete two rotations of the circuit, which totaled to approximately 26 minutes. Once the exercise portion was complete, participants proceeded to the cooldown phase, which consisted of a standardized whole-body stretching routine. Each workout was monitored by a trained fitness instructor who ensured proper exercise technique was used while also ensuring appropriate exercise intensity. Participants' attendance was recorded at each session to ensure the study's minimal 70% compliance (21/30 exercise sessions). Participants were also encouraged to walk or engage in physical activity for at least 30 minutes per day on the days they did not complete circuit training; however, these results were not quantified within the context of this particular study.

Table 3.3. Exercises and machines used in circuit-style program adapted from "Effects of Higher Carbohydrate or Higher Protein Diets with Exercise on Individual Risk Factors of Metabolic Syndrome in Women".

Calisthenic Exercises	**Exercise Machines**	
arm circles	chest press/ seated row	abdominal crunch / back
boxing moves	elbow flexion/ extension	extension
high knees	hip abductor/ adductor	hip extension
leg kicks	horizontal leg press	oblique twist
running in place	knee flexion/ extension	pec dec
stepping	shoulder press/ lateral pull	shoulder shrug / dip
	squat	side bends

Note: adapted from [192].

Testing Protocols

Dietary Inventories

Participants were instructed to record their food and fluid intake for 4 days prior to each testing session (3 weekdays and 1 weekend day). These records were analyzed by a registered dietician who then analyzed the caloric and macronutrient intakes, using ESHA Food Processor Nutritional Analysis Software (*Version 8.6, 2006, ESHA Research Inc., Salem OR*).

Anthropometric Measurements

Height, weight, hip, and waist measurements were procured at every testing session. Height and weight were assessed using standardized procedures on a calibrated electronic scale (*Cardinal Detecto Scale Model 8439, Webb City, Missouri*) with a precision of ± 0.02 kg. Hip and waist circumference measurements were taken using a tension-controlled tape measure in accordance with the guidelines established by the American College of Sports Medicine [129].

Resting Energy Expenditure

To measure resting energy expenditure (REE), the ParvoMedics TrueMax 2400 Metabolic Measurement System (*ParvoMedics Inc., Sandy, UT*) was implemented. Participants were required to fast for a minimum of 12 hours before lying supine on the exam table with their legs propped up at a 90-degree angle. Once in this position, participants were instructed to remain motionless and not to fall asleep during an approximate 20-minute monitoring period. During this time, a clear metabolic canopy was placed over each participant's head and neck to measure resting oxygen uptake (VO_2) and energy expenditure. After 10 minutes, metabolic measurements were taken. Principle variables (such as VO_2 L/min) were monitored so that changes no more than 5% occured within a five minute period [199]. According to the manufacturer, the coefficient of variation for this device in healthy, lean individuals is ± 2%.

Body Composition

Body composition protocol included total body scanned mass, fat-free mass, fat mass, and body fat percentage. Body composition (except the cranium) was measured with the Hologic Discovery W (*Hologic Inc., Waltham, MA*) dual energy x-ray absorptiometer (DEXA) along with APEX Software (*APEX Corporation Software, Pittsburg, PA*). Research has validated the use of DEXA for reliable body composition measurement as accurate [200, 201]. Test-retest studies that assessed reliability specifically on total fat-free /soft tissue mass performed on this DEXA instrument have previously rendered mean coefficients of variation of 0.31%–0.45% as well as a mean intraclass correlation of 0.985 [202].

Resting Cardiovascular Parameters

While in the supine position and after having rested for at least 5 minutes, participants' blood pressure and heart rate were measured, utilizing standard clinical procedures. Heart rate was assessed through palpation of the radial artery. Blood pressure was measured with a manual mercurial sphygmomanometer (*American Diagnostic Corporation, model #AD-720, Hauppauge, NY*) as well as a stethoscope auscultation of the brachial artery [129].

Blood Collection and Analysis

Using standard phlebotomy techniques, fasted serum blood samples were collected through a sterile venipuncture of an antecubital vein. The sample tubes were then centrifuged at 1100 x g for 15 minutes utilizing a standard bench top centrifuge (*Cole Palmer, Vernon Hills, IL, Model $ 17250-10*). Blood serum samples were extracted with a pipette and then placed into microcentrifuge tubes, which were frozen and stored at -20º C so they could be analyzed later for clinical chemistry panels. A complete metabolic panel was carried out to measure serum samples, using a calibrated Dade Behring Dimension RXL (*Siemens AG, Munich, Germany*) automated clinical chemistry analyzer. The coefficients of variation for the tests, utilizing this analyzer, was analogous to those of previously published data for these tests (range: 1.0%–9.6%) [203]. When the Dade was unavailable, serum samples were sent to and analyzed by Quest Diagnostics (*Quest Diagnostics, 5850 Rogerdale Road, Houston, TX, USA 77072*), utilizing an Olympus AAU 5400 Chemistry Immuno Analyzer (*Olympus America Inc., Center Valley, PA, USA*). Duplicates of fasting insulin were obtained to be assayed, utilizing a commercially available Enzyme Linked Immunosorbent Assay (ELISA) kit (NO. 80-INSHU-E10, ALPCO, Salem, NH). The BioTek ELX-808 Ultramicroplate reader (*BioTek Instruments Inc., Winooski, VT*) was used at an optical density of 450 nm against an established standard curve utilizing procedures with BioTek Gen5 Analysis Software (*BioTek Instruments Inc., Winooski, VT*). The intra-assay variation coefficient had been demonstrated to range from 2.9% to 6.2%, with a variation coefficient range of 5.4% to 8.6% (*ALPCO, Salem, NH*). The Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) was determined based on the product of fasting insulin (µU/mL) and fasting glucose (mg/dL) and furthermore divided by 405 [204].

Fitness Assessments

Maximal Cardiopulmonary Exercise Test

To assess peak aerobic capacity (peak VO_2), a symptom-limited Bruce maximal treadmill exercise protocol was performed at every testing session [129]. Both the Quinton 710 Electrocardiogram (ECG; *Quinton Instruments, Bothell, WA*), Trackmaster TMX425C treadmill (*JAS Fitness Systems, Newton, KS*), and Parvo Medics 2400 TrueMax Metabolic Measurement System (*ParvoMedics, Inc., Sandy, UT*) were used. The mean coefficient of variation for determining peak VO_2, utilizing the Bruce protocol, had been previously assessed to be 6.5%

(range 2.0%–14%) [205]. Prior to testing each morning, gas and flow sensors were calibrated to within 3% of the previous calibration point.

Utilizing a standard 12-lead arrangement, blood pressure, heart rate, and rate of perceived exertion (RPE) were monitored throughout the testing session [129]. The cardiorespiratory treadmill tests were conducted by experienced, trained laboratory assistants. ECG outputs were analyzed prior to exercise testing to ensure there were no contraindications [129]. The Bruce treadmill protocol was implemented in accordance with the speeds and grades listed in the standard protocol [206]. Printouts of the ECG, BP, and RPE were collected near the end of each stage. Participants were encouraged by research assistants to exercise to their maximal potential. However, if clinical symptoms within patients became evident this required termination of the test [129]. Upon completion of the exercise test, participants then performed an active recovery for 3 minutes, which preceded a 3-minute seated recovery time.

Isotonic Strength Tests

To determine upper and lower body maximal strength and endurance, a standard isotonic Olympic bench press and a 45° hip sled/leg press (*Nebula Fitness, Versailles, OH*) were utilized in this assessment. Experienced lab assistants conducted all exercise testing and strength tests. Assistants ensured proper hand positioning on the bench press as well as appropriate seat and foot positioning on the leg press and noted them accordingly to maintain consistency between testing sessions. Based on test-retest reliability comparisons executed by trained participants in the ESNL, results demonstrate a low mean coefficient of variation and high reliability (bench press 1.9%, intraclass $r = 0.94$ and leg press: 0.7%, intraclass $r = 0.91$) [207].

To effectively measure upper and lower body strength, participants were instructed to perform a one rep maximum (1RM) protocol. This protocol commenced with individuals engaging in a warm-up period (two sets of 10 repetitions at approximately 50% of anticipated 1RM). Next, participants engaged in a progressive increase of 1RM attempts (5 lb. – 10 lbs. on the bench press, 10 lbs. – 25 lbs. on the leg press). Once an attempt was made, participants rested for 2 minutes before attempting a heavier weight. This process was repeated until 1RM was achieved. Once a participant's 1RM had been determined, participants proceeded to rest for 4 minutes before engaging in an upper body muscular endurance test, performing AMRAP until failure, at a calculated weight of 80% of their 1RM [208].

Psychosocial Assessments

Psychosocial assessments were utilized to assess experience and results gained throughout the entirety of the study. At each testing session, participants completed the SF-36 Health-Related Quality of Life Survey as well as the Body Image Questionnaire (see Appendices A and B) [209, 210]. The SF-36 examined various mental and physical components, including mental health (state of feelings of calmness, happiness, and peacefulness), role emotion (problems with occupation or other activities), social functioning (capacity to perform normal social activities), vitality (perceived energy level), general health (appraisal of personal health), bodily pain (constraints due to pain), role physical (capability to work and execute daily tasks and activities), and physical functioning (the capacity to engage in most vigorous physical activities without any contraindications to health). The Body Image Questionnaire was also administered; it consisted of three questionnaires, including the Social Physique Anxiety Scale (SPAS); the Rosenberg Self-Esteem Scale (RSE), which examines global, unidimensional self-esteem; and the Multidimensional Body-Self Relations Questionnaire (MBSRQ-AS), which regards self-attitudinal tendencies towards the physical construct, including appearance orientation, appearance evaluation, body area satisfaction scale, overweight preoccupation, and self-classified weight [195, 196, 211].

Statistical Analysis

Only data from participants who completed the 10-week intervention were included in the analysis. Cases with missing data points were eliminated from this analysis.

The analysis was performed retrospectively on 207 women (N = 207) who participated in the intervention from eight previous weight loss studies in the ESNL. Participants were not categorized into any particular group based upon the study in which they participated.

The statistical analysis was performed using SPSS (*Version 27, IBM Corporation, Armonk, NY*). Participants' baseline demographics were analyzed by descriptive statistics. Related variables were grouped together but analyzed independently with a bivariate correlational analysis. Delta values were computed by subtracting the baseline testing session (T1) from the 10-week testing session (T2–T1). Percent changes were then computed by subtracting T1 from T2, then dividing by T1, and finally multiplying by 100 [(T2–T1)/T1*100].

Changes were deemed statistically significant when the probability of a type I error was ≤ 0.05.

CHAPTER IV

RESULTS

Introduction

While there have been a multitude of weight loss studies conducted in conjunction with a battery of psychometric questionnaires ranging from self-esteem, body image, social physique anxiety, to overall quality of life, emerging research has only recently relied on more precise tools and measurements of body composition analysis such as DEXA. Most often, this is a reflection of the available funding and resources provided to the investigative team. Regardless, with more recent innovation of technology, there have been rare cases in which body composition components were found to be correlated to psychological outcomes. In other words, overall weight loss on a commonplace scale says nothing about what was reduced to account for the weight loss: body water, body fat, or lean body mass. Therefore, once an individual has the specific knowledge of each component, this begs the question of whether this new information alters or impacts measurements of quality of life, self-esteem, social physique anxiety, and body image. Accordingly, the purpose of this study was to examine whether definitive changes in anthropometric and body composition resulting from a supervised 10-week weight loss diet and exercise intervention impacted psychological survey results of previously sedentary participants.

Through the retrospective analysis of eight 10-week weight loss studies administered both in the Baylor University and Texas A&M University ESNL, multiple bivariate correlational analyses were conducted to determine the strength between changes in anthropometrics and body composition in relation to resulting post-intervention psychometric questionnaires of quality of life and body image.

Baseline Demographics

Table 4.1 displays the baseline demographics for the overall study group. The number of female participants who participated in the study was 207. Participants were 47.6 ± 13.2 years of age, 64 ± 2.6 in. in height, 203 ± 42.1 lbs. in weight, and categorized as obese with a BMI of 34.8 ± 6.4 kg/m^2 (mean ± standard deviation), and a body fat percentage of 34.7 ± 6.4%. Cases with missing data points were excluded from this analysis.

Table 4.1. Baseline demographics.

Study	N	Age	Height	Weight	BMI	Fat %
Overall	207	47.6±13.2	64±2.6	203±42.1	34.7±6.4	45.1±4.4

Height in inches, weight in lbs., fat percentage measured via DEXA.

Table 4.2 depicts the baseline, 10-week follow-up, and overall average percent change of independent variables, including anthropometrics (weight, waist/hip ratio, and BMI) and body composition analysis via the DEXA scan (subtotal fat, subtotal lean mass and bone mineral content, and fat percentage).

Table 4.2. Anthropometrics and body composition analysis via DEXA scan before and after 10 weeks of exercise and dietary intervention.

Variable	Baseline			10 Weeks			Delta Values			Percent Change (%)			P-Value
Weight (lbs.)	203.0	±	42.1	196.2	±	39.8	-6.7	±	7.6	-3.2	±	3.6	.000
BMI (kg/m^2)	34.7	±	6.3	33.6	±	6.1	-1.1	±	1.3	-3.2	±	3.6	.000
Waist/Hip Ratio	0.8	±	0.08	0.8	±	0.08	-0.001	±	0.06	0.04	±	6.8	.780
DEXA Subtotal Fat (grams)	39052.4	±	11180.6	36384.5	±	10436.7	-2667.9	±	4294.2	-6.3	±	8.3	.000
DEXA Subtotal Lean + BMC (grams)	46533.1	±	8381.3	46154.2	±	7937.5	-378.9	±	2013.9	-0.6	±	4.2	.007
DEXA Subtotal Fat Percentage (%)	45.1	±	4.4	43.7	±	4.3	-1.3	±	2.0	-3.0	±	4.5	.000

Table 4.3 represents the baseline, 10-week follow-up, and overall average percent change of dependent psychometric variables, including Quality of Life Inventory (SF-36) and Body Image Questionnaire (Rosenberg Self-Esteem Scale, Social Physique Anxiety Scale, and MBSRQ-AS).

Table 4.3. Quality of Life Inventory (SF-36) & Body Image Questionnaire (Rosenberg Self-Esteem Scale, Social Physique Anxiety Scale, & MBSRQ-AS) values after 10 weeks of exercise and dietary intervention.

Variable	Baseline	10 Weeks	Delta Values	Percent Change (%)	P-Value
SF-36: Physical Functioning Score	74.8 ± 29.2	84.2 ± 25.3	9.3 ± 26.6	34.1 ± 127.5	.000
SF-36: Role Physical Score	130.0 ± 136.2	130.0 ± 143.6	0.5 ± 50.9	8.2 ± 67.2	.887
SF-36: Bodily Pain Score	67.0 ± 17.8	70.9 ± 16.6	3.9 ± 18.0	12.9 ± 40.9	.002
SF-36: General Health Score	49.0 ± 28.8	53.8 ± 29.5	4.7 ± 11.2	16.3 ± 33.1	.000
SF-36: Vitality Score	40.0 ± 34.4	46.0 ± 36.5	6.1 ± 15.1	25.4 ± 52.4	.000
SF-36: Social Functioning Score	39.2 ± 17.4	40.8 ± 17.2	1.6 ± 13.5	10.4 ± 38.9	.089
SF-36: Role Emotional Score	221.2 ± 133.3	235.9 ± 145.2	14.6 ± 72.3	16.3 ± 93.5	.004
SF-36: Mental Health Score	59.2 ± 16.6	68.3 ± 16.0	9.2 ± 16.6	22.9 ± 43.0	.000
Rosenberg Self-Esteem Scale	25.4 ± 3.3	25.8 ± 3.0	0.4 ± 2.8	2.4 ± 12.5	.031
Social Physique Anxiety Scale	31.67 ± 5.7	31.5 ± 5.2	-0.2 ± 5.9	1.3 ± 18.6	.687
MBSRQ-AS: Appearance Evaluation	2.3 ± 0.7	2.6 ± 0.8	0.3 ± 0.7	18.5 ± 34.0	.000
MBSRQ-AS: Appearance Orientation	3.8 ± 0.7	3.8 ± 0.7	-0.1 ± 0.4	-1.3 ± 11.3	.016
MBSRQ-AS: Body Area Satisfaction	2.4 ± 0.6	3.0 ± 0.7	0.3 ± 0.4	12.5 ± 19.3	.000
MBSRQ-AS: Overweight Preoccupation	3.0 ± 0.7	3.3 ± 0.7	0.3 ± 0.7	14.7 ± 31.1	.000
MBSRQ-AS: Self-Classified Weight	4.3 ± 0.7	4.1 ± 0.7	-0.2 ± 0.7	-1.3 ± 32.8	.000

Analysis of Weight and BMI

A bivariate correlation on the differences of the 10-week trial values and baseline values (T_3–T_1) revealed some significance between weight/BMI and specific quality of life measures (SF-36; see correlations in Table 4.4). Correlations with vitality score, $r(205) = -.20$, $p < .01$, and role emotional, $r(205) = -.16$, $p < .05$, were shown to be statistically significant, demonstrating that as participants lost weight and their BMI scores decreased, their scores of vitality, pep and energy, as well as role emotional, fewer problems with work or other daily activities, increased. When examining percent change score correlations between 10-week trial values and baseline values $(T_3 – T_1)/T_1$ (see correlations on Table 4.5), measures of general health, $r(205) = -.16$, $p < .05$, and vitality, $r(205) = -.17$, $p < .05$, presented as significant, thereby further reinforcing the vitality score as a significant correlation, but also demonstrating the significance of general health, evaluation of personal health as excellent, in relation to improved weight loss [194, 212]. Considering the weak but significant relationships between a few subsections of the SF-36, hypothesis H_1 is partially accepted, stating there will be a significant relationship between changes in weight/BMI and outcome measures of quality of life (SF-36).

Using bivariate correlation analysis on the differences of the 10-week trial values and baseline values $(T_3 – T_1)$ revealed some significance between weight/BMI and specific outcome measures of body image (MBSRQ-AS; see correlations on Table 4.4). Correlations with appearance evaluation scores, $r(205) = -.17$, $p < .05$, and overweight preoccupation scores, $r(205) = -.15$, $p < .05$, were demonstrated to be significant, presenting that as participants lost weight and their BMI scores decreased, their scores of appearance evaluation, positive feelings and satisfaction with one’s appearance increased while increased overweight preoccupation scores reflected lessening fat anxiety in conjunction with increased dieting, eating restraint, and weight vigilance. When examining percent change score correlations between 10-week trial values and baseline values $(T_3 – T_1)/T_1$ (see correlations on Table 4.5), measures of self-classified weight became significant, $r(205) = -.15$, $p < .05$, delineating that an individual perceived herself as less overweight after the intervention, as well as further emphasizing the significant correlations with appearance evaluation, $r(205) = -.19$, $p < .01$, and overweight preoccupation,

$r(205) = -.15$, $p < .05$ [195]. In view of the weak but significant correlations between a few subsections of the MBSRQ-AS, hypothesis H_4 is partially accepted, stating there will be a significant relationship between changes in weight/BMI and outcome measures of body image (MBSRQ-AS).

When testing for correlations between differences in weight and BMI as well as change scores of self-esteem (RSE) and social physique anxiety (SPAS), there were no significant relationships between any of these variables. Therefore, based on this evidentiary support, hypotheses H_7 and H_{10}, are rejected, which stated that there will be a significant relationship between changes in weight/BMI and outcome measures of self-esteem (RSE) as well as there will be a significant relationship between changes in weight/BMI and outcome measures of social physique anxiety (SPAS).

Analysis of Anthropometrics

A bivariate correlation on the differences of the 10-week trial values and baseline values (T_3–T_1) revealed some significance between anthropometric measurements of waist/hip ratio and specific quality of life measures (SF-36; see correlations on Table 4.4). Correlations with social functioning score, $r(205) = .15$, $p < .05$, appeared significant, revealing that as waist/hip ratio increased, scores of social functioning, which demonstrate the ability to perform normal social activities without interference from emotional or physical problems, increased. When examining percent change score correlations between 10-week trial values and baseline values (T_3–T_1)/T_1 (see correlations on Table 4.5), measures of social functioning, $r(205) = .18$, $p < .05$, presented as significant, thereby further reinforcing social functioning as a significant correlation with decreasing waist/hip ratio [194, 212]. Acknowledging the weak, but significant relationship between one subsection of the SF-36, hypothesis H_2 is partially accepted stating that there will be a significant relationship between changes in anthropometrics (waist/hip ratio) and outcome measures of quality of life.

Using bivariate correlation analysis on the differences of the 10-week trial values and baseline values (T_3–T_1) revealed some significance between anthropometrics and specific outcome measures of body image (MBSRQ-AS; see correlations on Table 4.4). Correlations with appearance evaluation scores, $r(205) = -.14$, $p < .05$, were shown to be significant, indicating that as waist/hip ratio decreased, scores of appearance evaluation increased, demonstrating greater positivity and satisfaction with one's appearance or greater feelings of physical attractiveness. When examining percent change score correlations between 10-week trial values and baseline values (T_3–T_1)/T_1, no significant interactions with outcome measures of body image appeared [195]. Since there was a weak, but significant relationship between one subsection of the MBSRQ-AS, hypothesis H_5 is partially accepted stating that there will be a significant relationship between changes in anthropometrics and outcome measures of body image.

When testing for correlations between differences in anthropometrics, specifically waist/hip ratio, as well as change scores of self-esteem and social physique anxiety, there were no significant relationships between any of these variables. Therefore, based on this evidentiary support, hypotheses H_8 and H_{11}, are rejected, which stated that there will be a significant relationship between changes in anthropometrics and outcome measures of self-esteem as well as there will be a significant relationship between changes in anthropometrics and outcome measures of social physique anxiety.

Analysis of Body Composition

A bivariate correlation on the differences of the 10-week trial values and baseline values (T_3–T_1) revealed some significance between body composition measurements of fat-free mass and specific quality of life measures (SF-36; see correlations on Table 4.4). Correlations with physical functioning score, $r(205) = -.19$, $p < .01$, bodily pain, $r(205) = -.14$, $p < .05$, and vitality, $r(205) = -.25$, $p < .01$, expressed significance, indicating that as fat-free mass decreased, scores of physical functioning increased. Physical functioning includes the ability to perform all types of physical activities without health limitations or bodily pain. Therefore, this result indicates no pain or limitations were present due to pain. Vitality was also present, which identifies with feeling full of energy and pep all of the time. When specifically looking at the bivariate correlation on the differences between fat percentage change and quality of life measures, role emotional, $r(205) = -.15$, $p < .05$, was the additional category within the body composition variable that demonstrated some significance, evincing that as overall body fat percentage decreased, role emotional scores, illustrating limited-to-no problems with work or other physical activities, increased. When examining percent change score correlations between 10-week trial values and baseline values $(T_3–T_1)/T_1$ (see correlations on Table 4.5), measures of general health, $r(205) = -.16$, $p < .05$, and vitality, $r(205) = -.18$, $p < .01$, presented as significant, thereby further reinforcing vitality score as a significant correlation and demonstrating the significance of general health, evaluation of personal health as excellent, in relation to decreased fat-free mass. Upon particular consideration of the percent change scores relative to fat loss percentage, role emotional, $r(205) = -.15$, $p < .05$, was further reinforced as significant by this bivariate relationship [194, 212]. In conclusion, in light of the weak but significant relationships between a few subsections of the SF-36, hypothesis H_3 is partially accepted, specifying there will be a significant relationship between changes in body composition (fat mass, fat-free mass, body fat percentage) and outcome measures of quality of life.

A bivariate correlation analysis on the differences of the 10-week trial values and baseline values (T_3–T_1) revealed some significance fat-free mass loss and specific outcome measures of body image (MBSRQ-AS; see correlations on Table 4.4). Correlations with appearance evaluation score, $r(205) = -.14$, $p < .05$, were significant, revealing that as participants lost fat-free mass, their scores of appearance evaluation, feelings of attractiveness or satisfaction with one's looks or appearance, increased. When examining percent change score correlations between 10-week trial values and baseline values (T_3–T_1)/T_1 (see correlations on Table 4.5), measures of self-classified weight, $r(205) = -.18$, $p < .05$, were shown to be significant reflecting that participants' scores decreased, therefore labeling themselves as less overweight. No significant correlations were found between body fat percentage and MBSRQ-AS, thereby hypothesis H_6 is partially accepted, demonstrating that there will be a significant relationship between changes in body composition and outcome measures of body image.

When testing for correlations between differences in body composition, specifically fat mass, fat-free mass, and body fat percentage, as well as change scores of self-esteem and social physique anxiety, there were no significant relationships between any of these variables. Therefore, based on this evidentiary support, hypotheses H_9 and H_{12}, are rejected, which assert there will be a significant relationship between changes in body composition and outcome measures of self-esteem, and there will be a significant relationship between changes in body composition and outcome measures of social physique anxiety.

Table 4.4. Correlational matrix for T_3–T_1 delta value differences.

Variable		weighdiff2	bmidiff2	waisthipdiff2	fatdiff2	ffmdiff2	fpdiff2	rsediff2	spadiff2	app_ediff2	app_odiff2	basdiff2
weighdiff2												
	Pearson Correlation	1	.994**	.026	.570**	.519**	.379**	-.109	.065	-.168*	.073	-.114
	p		.000	.709	.000	.000	.000	.119	.354	.015	.299	.102
	N	207	207	207	207	207	207	207	207	207	207	207
bmidiff2												
	Pearson Correlation	.994**	1	.023	.563**	.516**	.381**	-.123	.077	-.166*	.081	-.119
	p	.000		.743	.000	.000	.000	.077	.272	.017	.246	.089
	N	207	207	207	207	207	207	207	207	207	207	207
waisthipdiff2												
	Pearson Correlation	.026	.023	1	-.143*	.097	-.050	-.074	-.039	-.138*	.104	-.104
	p	.709	.743		.039	.162	.479	.287	.577	.047	.134	.135
	N	207	207	207	207	207	207	207	207	207	207	207
fatdiff2												
	Pearson Correlation	.570**	.563**	-.143*	1	.055	.401**	-.017	.078	-.054	.066	-.073
	p	.000	.000	.039		.433	.000	.810	.263	.441	.346	.294
	N	207	207	207	207	207	207	207	207	207	207	207
ffmdiff2												
	Pearson Correlation	.519**	.516**	.097	.055	1	-.500**	-.059	-.014	-.139*	.017	-.069
	Sig. (2-tailed)	.000	.000	.162	.433		.000	.398	.845	.046	.807	.324
	N	207	207	207	207	207	207	207	207	207	207	207
fpdiff2												
	Pearson Correlation	.379**	.381**	-.050	.401**	-.500**	1	-.067	.031	-.072	.117	-.081
	p	.000	.000	.479	.000	.000		.338	.663	.299	.093	.248
	N	207	207	207	207	207	207	207	207	207	207	207
rsediff2												
	Pearson Correlation	-.109	-.123	-.074	-.017	-.059	-.067	1	-.056	.018	.032	.075
	p	.119	.077	.287	.810	.398	.338		.421	.792	.650	.280
	N	207	207	207	207	207	207	207	207	207	207	207

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

Table 4.4. Continued

Variable	weighdiff2	bmidiff2	waisthipdiff2	fatdiff2	ffmdiff2	fpdiff2	rsediff2	spadiff2	app_ediff2	app_odiff2	basdiff2
spadiff2											
Pearson Correlation	.065	.077	-.039	.078	-.014	.031	-.056	1	.123	.064	.007
p	.354	.272	.577	.263	.845	.663	.421		.078	.363	.921
N	207	207	207	207	207	207	207	207	207	207	207
app_ediff2											
Pearson Correlation	-.168*	-.166*	-.138*	-.054	-.139*	-.072	.018	.123	1	-.110	.327**
p	.015	.017	.047	.441	.046	.299	.792	.078		.115	.000
N	207	207	207	207	207	207	207	207	207	207	207
app_odiff2											
Pearson Correlation	.073	.081	.104	.066	.017	.117	.032	.064	-.110	1	-.081
p	.299	.246	.134	.346	.807	.093	.650	.363	.115		.247
N	207	207	207	207	207	207	207	207	207	207	207
basdiff2											
Pearson Correlation	-.114	-.119	-.104	-.073	-.069	-.081	.075	.007	.327**	-.081	1
p	.102	.089	.135	.294	.324	.248	.280	.921	.000	.247	
N	207	207	207	207	207	207	207	207	207	207	207
overpdiff2											
Pearson Correlation	-.151*	-.157*	-.067	-.094	-.059	-.068	.079	-.010	-.051	.191**	.002
p	.030	.024	.336	.176	.396	.331	.260	.886	.466	.006	.981
N	207	207	207	207	207	207	207	207	207	207	207
selfdiff2											
Pearson Correlation	-.011	-.009	-.061	-.006	-.058	.042	.147*	.026	.002	-.084	-.044
p	.871	.901	.386	.932	.404	.550	.035	.705	.979	.227	.527
N	207	207	207	207	207	207	207	207	207	207	207
phy_fdiff2											
Pearson Correlation	-.109	-.121	-.036	.002	-.185**	.071	.019	.046	.151*	.060	.117
p	.118	.082	.606	.974	.008	.310	.785	.508	.030	.390	.092
N	207	207	207	207	207	207	207	207	207	207	207

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

Table 4.4. Continued

Variable	weighdiff2	bmidiff2	waisthipdif f2	fatdiff2	ffmdiff2	fpdiff2	rsediff2	spadiff2	app_ediff2	app_odiff2	basdiff2
rol_pdiff2											
Pearson Correlation	-.131	-.134	-.027	-.085	-.026	-.032	.039	.008	-.024	.020	.106
p	.060	.054	.695	.222	.710	.646	.581	.909	.737	.769	.127
N	207	207	207	207	207	207	207	207	207	207	207
bod_pdiff2											
Pearson Correlation	-.121	-.126	-.117	-.011	-.143*	.031	-.001	.090	.189**	-.050	.098
p	.081	.071	.093	.880	.040	.659	.989	.195	.006	.476	.159
N	207	207	207	207	207	207	207	207	207	207	207
gen_hdiff2											
Pearson Correlation	-.114	-.106	.040	-.047	-.123	-.044	.012	-.002	.133	-.084	.102
p	.103	.129	.569	.498	.077	.529	.869	.975	.057	.231	.146
N	207	207	207	207	207	207	207	207	207	207	207
vitaldiff2											
Pearson Correlation	-.197**	-.210**	-.108	-.031	-.250**	.030	.214**	.003	.099	.018	.169*
p	.004	.002	.122	.654	.000	.664	.002	.970	.156	.800	.015
N	207	207	207	207	207	207	207	207	207	207	207
soc_fdiff2											
Pearson Correlation	-.039	-.045	.152*	-.053	.091	-.119	-.042	-.101	.041	-.050	.016
p	.580	.516	.029	.451	.193	.087	.548	.147	.558	.477	.818
N	207	207	207	207	207	207	207	207	207	207	207
rolemdiff2											
Pearson Correlation	-.157*	-.178*	-.015	-.136	-.007	-.153*	-.022	-.037	.097	-.065	.116
p	.024	.010	.827	.050	.925	.028	.756	.596	.162	.350	.097
N	207	207	207	207	207	207	207	207	207	207	207
men_hdiff2											
Pearson Correlation	-.089	-.095	-.042	-.048	-.035	-.112	.159*	-.009	.176*	.028	.249**
p	.204	.174	.549	.490	.620	.108	.022	.894	.011	.692	.000
N	207	207	207	207	207	207	207	207	207	207	207

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

Table 4.4. Continued

Variable	overpdiff2	selfdiff2	phy_fdiff2	rol_pdiff2	bod_pdiff2	gen_hdiff2	vitaldiff2	soc_fdiff2	rolemdiff2	men_hdiff2
weighdiff2										
Pearson Correlation	-.151*	-.011	-.109	-.131	-.121	-.114	-.197**	-.039	-.157*	-.089
p	.030	.871	.118	.060	.081	.103	.004	.580	.024	.204
N	207	207	207	207	207	207	207	207	207	207
bmidiff2										
Pearson Correlation	-.157*	-.009	-.121	-.134	-.126	-.106	-.210**	-.045	-.178*	-.095
p	.024	.901	.082	.054	.071	.129	.002	.516	.010	.174
N	207	207	207	207	207	207	207	207	207	207
waisthipdiff2										
Pearson Correlation	-.067	-.061	-.036	-.027	-.117	.040	-.108	.152*	-.015	-.042
p	.336	.386	.606	.695	.093	.569	.122	.029	.827	.549
N	207	207	207	207	207	207	207	207	207	207
fatdiff2										
Pearson Correlation	-.094	-.006	.002	-.085	-.011	-.047	-.031	-.053	-.136	-.048
p	.176	.932	.974	.222	.880	.498	.654	.451	.050	.490
N	207	207	207	207	207	207	207	207	207	207
ffmdiff2										
Pearson Correlation	-.059	-.058	-.185**	-.026	-.143*	-.123	-.250**	.091	-.007	-.035
p	.396	.404	.008	.710	.040	.077	.000	.193	.925	.620
N	207	207	207	207	207	207	207	207	207	207
fpdiff2										
Pearson Correlation	-.068	.042	.071	-.032	.031	-.044	.030	-.119	-.153*	-.112
p	.331	.550	.310	.646	.659	.529	.664	.087	.028	.108
N	207	207	207	207	207	207	207	207	207	207
rsediff2										
Pearson Correlation	.079	.147*	.019	.039	-.001	.012	.214**	-.042	-.022	.159*
p	.260	.035	.785	.581	.989	.869	.002	.548	.756	.022
N	207	207	207	207	207	207	207	207	207	207

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

Table 4.4. Continued

Variable	overpdiff2	selfdiff2	phy_fdiff2	rol_pdiff2	bod_pdiff2	gen_hdiff2	vitaldiff2	soc_fdiff2	rolemdiff2	men_hdiff2
spadiff2										
Pearson Correlation	-.010	.026	.046	.008	.090	-.002	.003	-.101	-.037	-.009
p	.886	.705	.508	.909	.195	.975	.970	.147	.596	.894
N	207	207	207	207	207	207	207	207	207	207
app_ediff2										
Pearson Correlation	-.051	.002	.151*	-.024	.189**	.133	.099	.041	.097	.176*
p	.466	.979	.030	.737	.006	.057	.156	.558	.162	.011
N	207	207	207	207	207	207	207	207	207	207
app_odiff2										
Pearson Correlation	.191**	-.084	.060	.020	-.050	-.084	.018	-.050	-.065	.028
p	.006	.227	.390	.769	.476	.231	.800	.477	.350	.692
N	207	207	207	207	207	207	207	207	207	207
basdiff2										
Pearson Correlation	.002	-.044	.117	.106	.098	.102	.169*	.016	.116	.249**
p	.981	.527	.092	.127	.159	.146	.015	.818	.097	.000
N	207	207	207	207	207	207	207	207	207	207
overpdiff2										
Pearson Correlation	1	-.071	.045	.054	-.023	-.127	.126	.006	.027	-.187**
p		.312	.522	.438	.744	.068	.070	.931	.698	.007
N	207	207	207	207	207	207	207	207	207	207
selfdiff2										
Pearson Correlation	-.071	1	-.076	-.003	-.089	-.137*	-.075	-.025	-.054	.034
p	.312		.275	.962	.203	.049	.286	.718	.438	.627
N	207	207	207	207	207	207	207	207	207	207
phy_fdiff2										
Pearson Correlation	.045	-.076	1	.167*	.200**	.173*	.175*	-.075	.161*	.039
p	.522	.275		.016	.004	.013	.012	.286	.020	.577
N	207	207	207	207	207	207	207	207	207	207

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

Table 4.4. Continued

Variable	overpdiff2	selfdiff2	phy_fdiff2	rol_pdiff2	bod_pdiff2	gen_hdiff2	vitaldiff2	soc_fdiff2	rolemdiff2	men_hdiff2
rol_pdiff2										
Pearson Correlation	.054	-.003	.167*	1	-.050	-.106	.021	.112	.408**	.084
p	.438	.962	.016		.473	.128	.767	.107	.000	.228
N	207	207	207	207	207	207	207	207	207	207
bod_pdiff2										
Pearson Correlation	-.023	-.089	.200**	-.050	1	.227**	.075	-.185**	.102	-.061
p	.744	.203	.004	.473		.001	.283	.008	.143	.381
N	207	207	207	207	207	207	207	207	207	207
gen_hdiff2										
Pearson Correlation	-.127	-.137*	.173*	-.106	.227**	1	.364**	.029	.013	.082
p	.068	.049	.013	.128	.001		.000	.679	.848	.239
N	207	207	207	207	207	207	207	207	207	207
vitaldiff2										
Pearson Correlation	.126	-.075	.175*	.021	.075	.364**	1	.028	-.004	.232**
p	.070	.286	.012	.767	.283	.000		.690	.959	.001
N	207	207	207	207	207	207	207	207	207	207
soc_fdiff2										
Pearson Correlation	.006	-.025	-.075	.112	-.185**	.029	.028	1	.120	.052
p	.931	.718	.286	.107	.008	.679	.690		.084	.457
N	207	207	207	207	207	207	207	207	207	207
rolemdiff2										
Pearson Correlation	.027	-.054	.161*	.408**	.102	.013	-.004	.120	1	.120
p	.698	.438	.020	.000	.143	.848	.959	.084		.085
N	207	207	207	207	207	207	207	207	207	207
men_hdiff2										
Pearson Correlation	-.187**	.034	.039	.084	-.061	.082	.232**	.052	.120	1
p	.007	.627	.577	.228	.381	.239	.001	.457	.085	
N	207	207	207	207	207	207	207	207	207	207

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

Table 4.5. Correlational matrix for (T_3–T_1)/T_1 percent changes.

Variable	weightpercentchange	bmipercentchange	waisthippercentchange	fatpercentchange	ffmpercentchange	fppercentchange	rsepercentchange	spapercentchange	app_epercentchange	app_opercentchange	baspercentchange
weightpercentchange											
Pearson Correlation	1	1.000**	-.005	.649**	.515**	.417**	-.114	.062	-.191**	.083	-.123
p		.000	.940	.000	.000	.000	.101	.375	.006	.233	.078
N	207	207	207	207	207	207	207	207	207	207	207
bmipercentchange											
Pearson Correlation	1.000**	1	-.005	.649**	.515**	.417**	-.114	.062	-.191**	.083	-.123
p	.000		.940	.000	.000	.000	.101	.375	.006	.233	.078
N	207	207	207	207	207	207	207	207	207	207	207
waisthippercentchange											
Pearson Correlation	-.005	-.005	1	-.145*	.100	-.073	-.084	-.050	-.105	.086	-.081
p	.940	.940		.037	.150	.298	.227	.476	.130	.217	.246
N	207	207	207	207	207	207	207	207	207	207	207
fatpercentchange											
Pearson Correlation	.649**	.649**	-.145*	1	.045	.594**	-.045	.048	-.125	.101	-.101
p	.000	.000	.037		.517	.000	.517	.488	.073	.148	.146
N	207	207	207	207	207	207	207	207	207	207	207
ffmpercentchange											
Pearson Correlation	.515**	.515**	.100	.045	1	-.478**	-.062	-.003	-.118	.033	-.073
p	.000	.000	.150	.517		.000	.378	.967	.090	.638	.293
N	207	207	207	207	207	207	207	207	207	207	207
fppercentchange											
Pearson Correlation	.417**	.417**	-.073	.594**	-.478**	1	-.063	.004	-.118	.110	-.065
p	.000	.000	.298	.000	.000		.369	.952	.092	.114	.355
N	207	207	207	207	207	207	207	207	207	207	207

Table 4.5. Continued

	weightpercentchange	bmipercentchange	waisthippercentchange	fatpercentchange	ffmpercentchange	fppercentchange	rsepercentchange	spapercentchange	app_epercentchange	app_opercentchange	baspercentchange
rsepercentchange											
Pearson Correlation	-.114	-.114	-.084	-.045	-.062	-.063	1	-.068	.030	-.002	.098
p	.101	.101	.227	.517	.378	.369		.334	.671	.972	.162
N	207	207	207	207	207	207	207	207	207	207	207
spapercentchange											
Pearson Correlation	.062	.062	-.050	.048	-.003	.004	-.068	1	.149*	.058	-.030
p	.375	.375	.476	.488	.967	.952	.334		.032	.410	.672
N	207	207	207	207	207	207	207	207	207	207	207
app_epercentchange											
Pearson Correlation	-.191**	-.191**	-.105	-.125	-.118	-.118	.030	.149*	1	-.057	.279**
p	.006	.006	.130	.073	.090	.092	.671	.032		.418	.000
N	207	207	207	207	207	207	207	207	207	207	207
app_opercentchange											
Pearson Correlation	.083	.083	.086	.101	.033	.110	-.002	.058	-.057	1	-.053
p	.233	.233	.217	.148	.638	.114	.972	.410	.418		.444
N	207	207	207	207	207	207	207	207	207	207	207
baspercentchange											
Pearson Correlation	-.123	-.123	-.081	-.101	-.073	-.065	.098	-.030	.279**	-.053	1
p	.078	.078	.246	.146	.293	.355	.162	.672	.000	.444	
N	207	207	207	207	207	207	207	207	207	207	207
overppercentchange											
Pearson Correlation	-.148*	-.148*	-.093	-.100	-.069	-.075	.046	.029	-.035	.195**	-.013
p	.033	.033	.183	.152	.323	.286	.507	.681	.621	.005	.856
N	207	207	207	207	207	207	207	207	207	207	207

Table 4.5. Continued

	weightpercentchange	bmipercentchange	waisthippercentchange	fatpercentchange	ffmpercentchange	fppercentchange	rsepercentchange	spapercentchange	app_epercentchange	app_opercentchange	baspercentchange
selfpercentchange											
Pearson Correlation	-.146*	-.146*	-.049	-.063	-.176*	.026	.154*	.025	.125	-.139*	.071
p	.036	.036	.482	.364	.011	.707	.027	.726	.073	.045	.308
N	207	207	207	207	207	207	207	207	207	207	207
phy_fpercentchange											
Pearson Correlation	-.091	-.091	-.118	-.050	-.102	.030	-.012	.171*	.113	.001	.062
p	.194	.194	.091	.473	.144	.666	.867	.014	.106	.991	.375
N	207	207	207	207	207	207	207	207	207	207	207
rol_ppercentchange											
Pearson Correlation	-.077	-.077	-.048	-.071	.071	-.092	-.021	.013	.024	.053	-.003
p	.268	.268	.493	.309	.312	.189	.760	.849	.734	.446	.961
N	207	207	207	207	207	207	207	207	207	207	207
bod_ppercentchange											
Pearson Correlation	-.103	-.103	-.108	-.015	-.112	.014	-.036	.073	.224**	-.078	.131
p	.139	.139	.121	.834	.108	.837	.604	.298	.001	.263	.059
N	207	207	207	207	207	207	207	207	207	207	207
gen_hpercentchange											
Pearson Correlation	-.156*	-.156*	.005	-.119	-.156*	-.030	.005	-.060	.214**	-.045	.173*
p	.024	.024	.949	.088	.025	.666	.949	.394	.002	.518	.013
N	207	207	207	207	207	207	207	207	207	207	207
vitalpercentchange											
Pearson Correlation	-.165*	-.165*	-.109	-.070	-.180**	-.002	.362**	-.036	.051	.055	.173*
p	.017	.017	.118	.319	.009	.980	.000	.604	.464	.431	.013
N	207	207	207	207	207	207	207	207	207	207	207

Table 4.5. Continued

	weightpercentchange	bmipercentchange	waisthippercentchange	fatpercentchange	ffmpercentchange	fppercentchange	rsepercentchange	spapercentchange	app_epercentchange	app_opercentchange	baspercentchange
soc_fpercentchange											
Pearson Correlation	-.050	-.050	.179*	-.063	.099	-.125	-.016	-.102	.052	-.028	.037
p	.472	.472	.010	.370	.156	.072	.822	.145	.459	.688	.595
N	207	207	207	207	207	207	207	207	207	207	207
rolempercentchange											
Pearson Correlation	-.099	-.099	-.059	-.116	.065	-.149*	-.080	.029	.087	-.010	.064
p	.155	.155	.397	.096	.350	.032	.254	.683	.211	.891	.357
N	207	207	207	207	207	207	207	207	207	207	207
men_hpercentchange											
Pearson Correlation	-.093	-.093	-.064	-.087	-.052	-.080	.137*	-.035	.165*	.010	.228**
p	.182	.182	.356	.215	.456	.253	.049	.615	.017	.882	.001
N	207	207	207	207	207	207	207	207	207	207	207

Table 4.5. Continued

Variable	overppercent change	selfpercentch ange	phy_fpercent change	rol_ppercent change	bod_ppercen tchange	gen_hpercen tchange	vitalpercentc hange	soc_fpercent change	rolempercen tchange	men_hperce ntchange
weightpercentchange										
Pearson Correlation	-.148*	-.146*	-.091	-.077	-.103	-.156*	-.165*	-.050	-.099	-.093
p	.033	.036	.194	.268	.139	.024	.017	.472	.155	.182
N	207	207	207	207	207	207	207	207	207	207
bmipercentchange										
Pearson Correlation	-.148*	-.146*	-.091	-.077	-.103	-.156*	-.165*	-.050	-.099	-.093
p	.033	.036	.194	.268	.139	.024	.017	.472	.155	.182
N	207	207	207	207	207	207	207	207	207	207
waisthippercentchange										
Pearson Correlation	-.093	-.049	-.118	-.048	-.108	.005	-.109	.179*	-.059	-.064
p	.183	.482	.091	.493	.121	.949	.118	.010	.397	.356
N	207	207	207	207	207	207	207	207	207	207
fatpercentchange										
Pearson Correlation	-.100	-.063	-.050	-.071	-.015	-.119	-.070	-.063	-.116	-.087
p	.152	.364	.473	.309	.834	.088	.319	.370	.096	.215
N	207	207	207	207	207	207	207	207	207	207
ffmpercentchange										
Pearson Correlation	-.069	-.176*	-.102	.071	-.112	-.156*	-.180**	.099	.065	-.052
p	.323	.011	.144	.312	.108	.025	.009	.156	.350	.456
N	207	207	207	207	207	207	207	207	207	207
fppercentchange										
Pearson Correlation	-.075	.026	.030	-.092	.014	-.030	-.002	-.125	-.149*	-.080
p	.286	.707	.666	.189	.837	.666	.980	.072	.032	.253
N	207	207	207	207	207	207	207	207	207	207
rsepercentchange										
Pearson Correlation	.046	.154*	-.012	-.021	-.036	.005	.362**	-.016	-.080	.137*
p	.507	.027	.867	.760	.604	.949	.000	.822	.254	.049
N	207	207	207	207	207	207	207	207	207	207

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

Table 4.5. Continued

Variable	overppercent change	selfpercentch ange	phy_fpercent change	rol_ppercent change	bod_ppercen tchange	gen_hpercen tchange	vitalpercentc hange	soc_fpercent change	rolempercen tchange	men_hperce ntchange
spapercentchange										
Pearson Correlation	.029	.025	.171*	.013	.073	-.060	-.036	-.102	.029	-.035
p	.681	.726	.014	.849	.298	.394	.604	.145	.683	.615
N	207	207	207	207	207	207	207	207	207	207
app_epercentchange										
Pearson Correlation	-.035	.125	.113	.024	.224**	.214**	.051	.052	.087	.165*
p	.621	.073	.106	.734	.001	.002	.464	.459	.211	.017
N	207	207	207	207	207	207	207	207	207	207
app_opercentchange										
Pearson Correlation	.195**	-.139*	.001	.053	-.078	-.045	.055	-.028	-.010	.010
p	.005	.045	.991	.446	.263	.518	.431	.688	.891	.882
N	207	207	207	207	207	207	207	207	207	207
baspercentchange										
Pearson Correlation	-.013	.071	.062	-.003	.131	.173*	.173*	.037	.064	.228**
p	.856	.308	.375	.961	.059	.013	.013	.595	.357	.001
N	207	207	207	207	207	207	207	207	207	207
overppercentchange										
Pearson Correlation	1	-.043	-.031	.020	-.007	-.087	.093	-.060	.006	-.128
p		.536	.662	.772	.924	.212	.185	.391	.932	.066
N	207	207	207	207	207	207	207	207	207	207
selfpercentchange										
Pearson Correlation	-.043	1	-.069	-.002	-.026	-.029	.060	-.018	-.045	.099
p	.536		.323	.976	.705	.673	.391	.796	.523	.154
N	207	207	207	207	207	207	207	207	207	207
phy_fpercentchange										
Pearson Correlation	-.031	-.069	1	.162*	.155*	.090	.058	.058	.222**	.026
p	.662	.323		.020	.026	.197	.405	.408	.001	.711
N	207	207	207	207	207	207	207	207	207	207

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

Table 4.5. Continued

Variable	overppercent change	selfpercentch ange	phy_fpercent change	rol_ppercent change	bod_ppercen tchange	gen_hpercen tchange	vitalpercentc hange	soc_fpercent change	rolempercen tchange	men_hperce ntchange
rol_ppercentchange										
Pearson Correlation	.020	-.002	.162*	1	-.145*	-.059	-.011	.303**	.718**	.084
p	.772	.976	.020		.037	.400	.870	.000	.000	.229
N	207	207	207	207	207	207	207	207	207	207
bod_ppercentchange										
Pearson Correlation	-.007	-.026	.155*	-.145*	1	.255**	.041	.017	-.016	-.057
p	.924	.705	.026	.037		.000	.557	.808	.817	.418
N	207	207	207	207	207	207	207	207	207	207
gen_hpercentchange										
Pearson Correlation	-.087	-.029	.090	-.059	.255**	1	.348**	.083	.075	.181**
p	.212	.673	.197	.400	.000		.000	.234	.281	.009
N	207	207	207	207	207	207	207	207	207	207
vitalpercentchange										
Pearson Correlation	.093	.060	.058	-.011	.041	.348**	1	-.002	-.033	.531**
p	.185	.391	.405	.870	.557	.000		.976	.634	.000
N	207	207	207	207	207	207	207	207	207	207
soc_fpercentchange										
Pearson Correlation	-.060	-.018	.058	.303**	.017	.083	-.002	1	.451**	.037
p	.391	.796	.408	.000	.808	.234	.976		.000	.594
N	207	207	207	207	207	207	207	207	207	207
rolempercentchange										
Pearson Correlation	.006	-.045	.222**	.718**	-.016	.075	-.033	.451**	1	.051
p	.932	.523	.001	.000	.817	.281	.634	.000		.470
N	207	207	207	207	207	207	207	207	207	207
men_hpercentchange										
Pearson Correlation	-.128	.099	.026	.084	-.057	.181**	.531**	.037	.051	1
p	.066	.154	.711	.229	.418	.009	.000	.594	.470	
N	207	207	207	207	207	207	207	207	207	207

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

CHAPTER V

SUMMARY

This study endeavored to establish whether changes in measures of weight/BMI, anthropometrics, and body composition over a 10-week diet and exercise intervention would ultimately influence changes in outcome measures of psychometrics, including quality of life (SF-36), body image (MBSRQ-AS), self-esteem (RSE), and social physique anxiety (SPAS). Overall, participants lost a significant amount of weight, decreased their BMIs, as well as reduced their body fat, fat-free mass, and fat percentage over the course of the examination. Changes in waist/hip ratio were not significant. Comprehensively, regarding psychosocial variables, there were significant improvements in quality of life, body image, and self-esteem. The exception were the SF-36 subsection measures of role-physical, indicating limited-to-no problems with work or other daily activities, which were found not to be significant [194, 212]. Additionally, social physique anxiety (SPAS) measures did not significantly change or improve over the course of the intervention.

Regarding the correlational differences between physiological variables and psychosocial outcomes pre- and post-intervention, various subsections of both quality of life and body image were demonstrated to be weakly related, but nevertheless significant. However, neither outcome measures of self-esteem nor social physique anxiety were shown to be significant. Previous research within the field offers to illuminate some of these discrepancies while also reinforcing some of the findings presented here.

Quality of Life

The SF-36 is a widely used, reliable assessment of functional status and patient well-being, indicative of quality of life, particularly when applied to weight loss and obesity research [65]. A study examining over 40,000 women found that women who had gained 5 pounds or more over the course of 4 years demonstrated significant impairment in SF-36 subscales of physical functioning, vitality, and bodily pain. By losing 5% or more of baseline body weight has been shown to have a positive influential effect on cardiovascular risk factors, self-esteem, and weight-related physical function [213]. There is a general consensus amongst the scientific community that mild caloric restriction in conjunction with increased physical activity is the best and safest approach most likely to yield reliable weight loss results [65]. Although there have been some assertions that exercise and weight loss interventions can lead to a number of psychological mood disturbances, this particular study contributes to one of many that demonstrate that such intervention instead improves psychological mood profiles and overall quality of life [14-16, 18, 25, 29, 65, 135, 150, 214-223].

When regarding the summary measures of the SF-36, there are two summary measures, physical health and mental health. Within physical health, there are subscales of physical functioning, role-physical, bodily pain, and general health, whereas within mental health there are subscales of vitality, social functioning, role-emotional, and mental health. Holistically, these measures comprise a number of operational indicators of health, but disregard aspects of health distress, cognitive functioning, family functioning, sexual functioning, sleep adequacy, communication, recreational hobbies, and problems and symptoms that relate to one condition in isolation [212]. One finding, corroborated by several studies, was that the physical components of the scale are really only reflective of treatments that alter physical health (i.e., body weight and BMI) and not measures of mental health [34, 212, 224, 225]. It has been asserted that mental scales tend to respond best to drug and counseling therapies that are specifically aimed at mental health interventions, however physical functioning as a subscale is the optimal measure of physical health, while mental health as a subscale is the most valid measurement of mental health as a summary measure [212].

While depression studies have demonstrated that subscales of mental health, role-emotional, and social functioning are the most responsive scales during pre- and post-intervention, the results of this present study showed there to be significant improvements within scores of vitality, role-emotional, general health, and social functioning [212]. Similar but slightly nuanced results were also found in another weight loss study, whereupon seven out of eight domains demonstrated significant improvement, including vitality, bodily pain, general health, social functioning, emotional role functioning, and mental health. Furthermore, weight loss not only mediated this relation between physical fitness and increases in general health and vitality, but also participants who had lost significant amounts of weight with little change in physical activity still had significant improvements in health-related quality of life measures (HRQL) [223]. Prior research has also demonstrated that morbidly obese patients had the worst SF-36 scores, and such decrements in health-related quality of life were furthermore correlated to the severity of their obesity [44].

In another 13-week weight loss intervention study, the following factors were found to be significant after treatment: weight loss, physical functioning, role-physical, general health, vitality, social functioning, and mental health. Additionally, this study also contributed a 1-year follow-up, which found weight loss, general health, vitality, and mental health continued to remain significant; however, there were only 32 participants in this study [42]. In a larger experiment, at 1-year post-intervention, physical composite scores were not significantly different from baseline measures. Mental composite scores as well as mental health, physical functioning, vitality, and general health all remained above baseline levels. When participants were revisited at 24-months post-intervention, subjects retained improvements above baseline in terms of physical functioning, mental composite score, and subscales of vitality and mental health [34]. Several of these studies fortify the crossover between behavioral weight loss interventions and quality of life outcome measures.

Even the National Institute of Health (NIH) has recognized and recommended that treatment considerations are best tailored to the needs of the patient and, therefore, emphasize the need for incorporating health-related quality of life issues into such diet and weight loss interventions [226]. Such measures have the capacity to not only improve quality of life but also decrease morbidity and mortality in a number of chronic conditions, thereby decreasing health care expenditure costs [65].

While a majority of research has been conducted on well-educated, White females [34]. Further research should be conducted on the impact of race, gender, level of education, and socioeconomic status as well as age on mental HRQL as mediators. It has been suggested that there is an inverse relationship between body weight as well as depressive symptoms in older adults [225]. It would also be advantageous to assess whether the particular type of physical activity utilized by participants in the exercise and weight loss intervention would impact HRQL [41]. Considerations should also be given to how two people of similar weights can have completely different scores of HRQL [226]. Arguably, this relates to self-perception, attitudes, and self-esteem, which begs the need for further behavioral psychological interventions [227].

Body Image

The MBSRQ-AS is a well-validated questionnaire that examines body image attitudes through 69 items with 10 specific subscales. This scale is driven in part by self-discrepancy theory, which asserts that people are motivated to maintain congruence between their actual self-concepts as well as their internalized ideals; however, such incongruence between the two factors is what purportedly gives rise to negative body image as well as other negative psychological states [228]. Having been theoretically innovated by Cash, researchers assert that having a negative image of one's appearance and body functioning is what ultimately leads to a reduction in quality of life. In fact, even when women hold the belief that they are fat, despite being of average weight, this belief can be more detrimental to body image and self-concept than actually physically being overweight [229]. It has, therefore, been hypothesized that weight loss might improve such negative body image concepts.

In the present research study, subsections of the MBSRQ-AS, including appearance evaluation, overweight preoccupation, and self-classified weight, were found to be significant in relation to various changes in weight/BMI, anthropometrics, and body composition over the course of a 10-week behavioral weight loss intervention. Additional research appears to corroborate some of these findings, demonstrating that women with higher BMI's tend to have lower levels of self-evaluation of their appearance. In fact, lower levels of such appearance evaluation were also related to poorer scores in quality of life measures specific to mental components. Such results were particularly evident in younger women who had a larger discrepancy between appearance evaluation and appearance orientation, which suggests a greater psychological burden compared to older female participants. Another unique finding of this study is that as women's BMI increased, there was a decrease in the perceived significance of presentation and appearance, which demonstrates a potential indifference or a psychological defense mechanism in relation to very poor body image [230].

It has also been found that exercise intensity plays a role in biological integrity. Females who engage in higher intensity levels of physical activity will have a greater investment in exercise as well as a greater belief in their physical abilities. However, such an association is not apparent at lighter levels of physical activity, nor is it evident that physical activity relates specifically to physical appearance attitudes [231]. Therefore, it would appear as though body image is heavily influenced by an individual's subjective well-being [232]. While research does suggest that women who highly regard their health and physical fitness are more likely to regularly participate in higher levels of physical activity, it is also conceivable that continually engaging in such moderate-to-vigorous levels of physical activity can aid women in forming or reinforcing an identity grounded in health and fitness [231].

Despite being well-validated and highly utilized, there has been some question in regard to the stability of one of the factors within the MBSRQ-AS, specifically appearance evaluation, which relates to the level of satisfaction one has with his or her appearance or feelings of attractiveness. It has been argued that the inherent subjectivity of this factor has the capacity to create inconsistent responses either representing as overly excessive concern or excessive concern that is not recognized [232]. Therefore, future research might necessitate further exploration and verification.

Additionally, prospective studies should examine the role of volition as well as behavioral intention towards lifestyle exercise, physical activity, and body image [231]. Retrospective data should also be collected to determine the impact of diet history as well as any previous experiences of weight criticism or humor, which may have led to more of a vulnerable body image. It should also be considered further why formerly overweight women do not significantly differ in terms of body image scores in relation to currently overweight counter participants [229]. This suggests that body image is as much psychological as it is physiological, thus reinforcing the intent behind this study.

Self-Esteem

Rosenberg Self-Esteem Scale (RSE) is one of the most reliable, widely utilized inventories of global self-esteem [233]. It is a 10-item instrument that measures feelings of self-worth on a 4-point agree-disagree scale [234]. Research has shown that when this scale is utilized in a cognitive behavioral program to improve body image, subjects reported significantly higher self-appearance evaluations as well as significant decreases in self-perceived body image problems. While there were no specific body areas of satisfaction, there was greater satisfaction with their overall appearance [149].

However, there have been some inconsistencies when regarding RSE in relation to various exercise intervention groups. While some evidence has shown that individuals who exercise regularly tend to have higher concepts of health and perceived health status than those held by non-exercisers or early adapters of the practice, it was also found that self-esteem scores for the group were nearly equal [235]. Even when item wording was altered within the questionnaire, there were no significant differences amongst outcome scores between the three versions. It has, therefore, been suggested that future efforts be focused on specifically eliminating measurement errors and creating a unidimensional scale of self-esteem [236].

While participants within this particular study did experience improvements in self-esteem scores over the course of the 10-week intervention, there were no significant interactions found between changes in weight, anthropometrics, and body composition in relation to RSE.

Alternative research has illuminated some possible disparities. Arguably, positively perceived health status plays a more predominant role in life-satisfaction [235]. Compliance with regular self-monitoring is another factor that also produced greater reductions in situational body image dysphoria [149]. Thematically, this suggests the need for greater mindfulness and personalization of treatment when endeavoring to sustainably improve self-esteem. To truly alter or change such self-concept, longer intervention might be needed.

It has been suggested that the Single-Item Self-Esteem Scale might provide a more practice alternative to the RSE, particularly in adult samples. However, some caveats include its lack of reliability, compared to that of the RSE, and it has greater susceptibility to outliers. Social desirability responding is an additional potential confounder [233].

Social Physique Anxiety

The Social Physique Anxiety Scale (SPAS) is a 12-item measured scale, evaluated on a 5-point Likert scale ranging from 12 to 60, that expresses the degree of anxiety an individual experiences based upon his or her physique being observed or publicly evaluated [237-239]. It has been suggested that the SPAS is a useful tool for identifying people who are high in physique anxiety or are perhaps overly preoccupied with bodily concerns. Research has purported that average levels of social physique anxiety are higher in females than in males, regardless of age [239]. Women who scored higher on the SPAS also typically experienced more distress than lower scoring participants, particularly when faced with a fitness-related evaluation [197]. It has also been found that social physique anxiety is often found more strongly in females since they feel the need to adhere to external societal pressures and cultural standards for body attractiveness [240]. However, it has been suggested that social physique anxiety increases in those of younger age, but only up to age 17 or 18 when it plateaus. This is due to younger women being exposed to idealized body images at an earlier age and, therefore, experiencing greater incongruence between "ideal" physique and actual physique [239].

The results of the present study revealed no significant changes from baseline to the end of the intervention. It can, therefore, be suggested that social physique anxiety either did not improve over the course of 10 weeks or perhaps the intervention was not long enough to yield significant results. Other research suggests there is no apparent relationship between social physique anxiety and frequency of physical activity, nor does it act as a moderator between physical self-perceptions and physical activity levels [237, 240]. Another possibility is that women did not have high enough baseline social physique anxiety scores to have significantly altered or decreased [22]. While it has been conjectured that exercising in front of mirrors increases self-awareness and thereby increases self-evaluation, driving negative social physique anxiety in females, an alternative perspective is that exercising in front of other women increases state anxiety due to self-perceptions in comparison to other females within the naturalistic exercise environment [241].

Perhaps the camaraderie provided within this particular exercise context promoted greater self-compassion amongst participants. It has been suggested that self-compassion within female exercisers is linked to greater levels of intrinsic motivation, naturally encouraging participants to give up harmful behaviors and to make more concentrated efforts towards improving well-being [237]. Another conjectured finding is that social physique anxiety has a positive relationship with autonomous forms of motivation and, therefore, lessens the negative predictive power of social physique anxiety on intention [242].

Accordingly, future research is required more specifically on self-esteem and self-compassion to better understand the process behind how and most optimally when women can develop greater self-compassion [237]. Autonomous forms of motivation, including intrinsic motivation, drive the intention to exercise; however, it is not entirely clear as to whether a combination of self-determined motives appear to be more advantageous and predictive of future success than one factor alone [242]. Therefore, social physique anxiety, functioning as either a punishment or form of shame or guilt, is not a strong predictor or motivator of exercise and/or accompanying weight loss behaviors.

Various other researchers have utilized the 9-item SPAS scale, asserting that it has shown similar reliability and validity scores to the 12-item questionnaire [237, 238, 241]. A 4-item scale has even been suggested as an appropriate substitution, demonstrating greater confidence in gender difference, however, potential complications with positive or negative wording [243]. It has been reported that the 12-item questionnaire had a higher level of internal consistency in older women [22].

Limitations and Recommendations for Future Research

Due to the context of this retrospective analysis, this study had a few limitations regarding the information and analysis available within this data set. Between the eight studies, there was a total of 207 participants who met the inclusion criteria based upon complete profiles. This study was restricted to women between the ages of 18 and 75 years and, therefore, may not be applicable either to younger women or men in aggregate. This data set was also secondary data; therefore, the intent to treat was beyond the researcher's control. Future studies should stratify data based on age, ethnicity, socioeconomic status, education, and previous diet and weight loss history. Intervention duration should be extended while also examining more longitudinal data to truly assess the adaptability and the sustainability of psychological outcomes. Further studies should be also administered to confirm external validity.

Additional studies should be conducted to address the specific reasons why participants drop out of behavioral weight loss programs or particularly what factors might be altered or enhanced in order to improve their attendance and adherence to programs. General research in this area of program attrition is incontrovertibly lacking.

Conclusion

Over the course of a 10-week intervention, female participants experienced notable physiological improvements, including weight loss as well as enhanced measures of anthropometrics and body composition. These significant psychological improvements included subsidiaries of body image and quality of life. Uniquely, this study demonstrates that even if minimal or even no significant changes in body composition or weight loss were obtained, women between the ages of 18-75 still experienced meaningful improvements in psychosocial outcomes. These findings further reinforce the idea that some physical activity is better than no physical activity, particularly when conducted in a same-sex group exercise environment such as Curves®.

While not specifically captured by the psychometric data, there are several factors that conceivably contributed to these participants' success within the program. Overall attendance and adherence to the program were foremost essential components. In addition, since these participants were formerly sedentary, not only did their knowledge base of such physical exercises increase but also their experience with and mastery of these exercises improved. Furthermore, these women were also exercising within a camraderous group setting with positive reinforcement from each other as well as being provided with external validation from the researchers who were ensuring correct exercise form and workout program completion. Therefore, while exercise may once have been considered an undesirable activity or perhaps even a painful one in certain instances due to delayed onset muscle soreness (DOMS), participants' interpretation of the workout process has arguably enhanced and changed. By having personal accountability for their routine success, ostensibly this also led to their marked improvements in psychosocial outcomes.

Comprehensively, the results of this study illustrate the combined psychological and physiological effects of partaking in a behavioral weight loss program and adds to the myriad of research that promotes such a holistic approach to lifestyle modification and improvement. Going forward, women should consider the following when attempting to lose weight, alter body composition, or improve body image and overall quality of life.

First, the pervasive problem of obesity starts with identification and classification. It is strongly suggested that women see their general practitioner to correctly identify their current health and obesity status to ensure there are no contraindications to either starting a dietary intervention or an exercise program.

Second, it is essential that a caloric deficit is created within one's regular diet, which can be achieved through a higher intake of protein, a lower intake of fat and sugar, a more conscientious intake of fibrous fruits, vegetables, and grains, and even intermittent fasting when appropriate.

Third, physical activity is imperative for weight loss and weight maintenance. Therefore, depending on the level of obesity, women should participate in a minimum of 150 minutes of moderate-to-vigorous physical activity per week. For greater weight losses, this recommendation can range anywhere from 225 minutes per week to 450 minutes per week based on tolerance and physical ability.

Fourth, adherence to the elected dietary and exercise regimen are required. Consistency can be achieved through daily weigh-ins and regular self-monitoring either a through a digital platform or pen and paper. Additionally, it is strongly encouraged that women avoid weight cycling as well as stimuli that prompt the overindulgence in calorically rich and nutritionally void food.

Fifth, there should be greater emphasis on positive body evaluation and self-acceptcance in order to attempt to mitigate social stigma and combat physiological stress within the body that can compromise weight loss efforts. Such an undertaking can be attempted by surrounding oneself by like-minded individuals who have similar goals and potentially want to workout together in a group environment and possibly hold people accountable.

Sixth, psychosocial awareness and regulation can positively reinforce this process and help ensure desired outcomes. In other words, most people in our modern-day, easy access and instant gratification environment are prone to weight gain. Fundamentally, women should be aware of their susceptibility to becoming overweight or obese. Once that is realized, it would also be advised that they exercise cognitive and physical restraint to the best of their abilities in terms of savory and sweet foods while also tolerating some dietary allowances without severe rigidity. Additionally, while rewards and punishements along with shame and guilt can be powerful motivators within finite instances, it is strongly recommended that women leverage their core values, beliefs, and behaviors in conjunction with their identities and what they find inherently enjoyable. These internally derived determinants will more assuredly produce success. Furthermore, women should continue to invest their time and attention to both resistance training and aerobic activity. While someone can be motivated by the success of others, personal experience is the greatest builder of individual confidence. Finally, there also has to be some tolerance in the readiness and willingness to change. Oftentimes, results do not occur as quickly is as desired and therefore patience and perseverance are instrumental in terms of maintainable lifestyle behavioral changes.

Nevertheless, significant weight loss and body composition changes are possible. And even if these changes don't occur, the mere participation in behavioral weight loss and exercise programs can produce compelling improvements in psychosocial measures of quality of life, body image, and self-esteem.

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APPENDIX A

THE SF-36 HEALTH SURVEY

The SF-36™ Health Survey

Instructions for Completing the Questionnaire

Please answer every question. Some questions may look like others, but each one is different. Please take the time to read and answer each question carefully by filling in the bubble that best represents your response.

<u>EXAMPLE</u>

This is for your review. Do not answer this question. The questionnaire begins with the section ***Your Health in General*** below.

For each question you will be asked to fill in a bubble in each line:

1. How strongly do you agree or disagree with each of the following statements?

	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
a) I enjoy listening to music.	○	●	○	○	○
b) I enjoy reading magazines.	●	○	○	○	○

Please begin answering the questions now.

Your Health in General

1. In general, would you say your health is:

Excellent	Very good	Good	Fair	Poor
○	○	○	○	○

2. **Compared to one year ago**, how would you rate your health in general <u>now</u>?

Much better now than one year ago	Somewhat better now than one year ago	About the same as one year ago	Somewhat worse now than one year ago	Much worse now than one year ago
○	○	○	○	○

Please turn the page and continue.

3. The following items are about activities you might do during a typical day. Does your **health now limit you** in these activities? If so, how much?

	Yes, Limited a lot	Yes, limited a little	No, not limited at all
a) **Vigorous activities**, such as running, lifting heavy objects, participating in strenuous sports	○	○	○
b) **Moderate activities**, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	○	○	○
c) Lifting or carrying groceries	○	○	○
d) Climbing **several** flights of stairs	○	○	○
e) Climbing **one** flight of stairs	○	○	○
f) Bending, kneeling, or stooping	○	○	○
g) Walking **more than a mile**	○	○	○
h) Walking **several blocks**	○	○	○
i) Walking **one block**	○	○	○
j) Bathing or dressing yourself	○	○	○

4. During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	Yes	No
a) Cut down on the **amount of time** you spent on work or other activities	○	○
b) **Accomplished less** than you would like	○	○
c) Were limited in the **kind** of work or other activities	○	○
d) Had **difficulty** performing the work or other activities (for example, it took extra time)	○	○

5. During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	Yes	No
a) Cut down on the **amount of time** you spent on work or other activities	○	○
b) **Accomplished less** than you would like	○	○
c) Didn't do work or other activities as **carefully** as usual	○	○

Please turn the page to continue.

6. During the **past 4 weeks**, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

Not at all	Slightly	Moderately	Quite a bit	Extremely
○	○	○	○	○

7. How much bodily pain have you had during the **past 4 weeks**?

None	Very mild	Mild	Moderate	Severe	Very severe
○	○	○	○	○	○

8. During the **past 4 weeks**, how much did pain interfere with your normal work (including both work outside the home and housework)?

Not at all	A little bit	Moderately	Quite a bit	Extremely
○	○	○	○	○

9. These questions are about how you feel and how things have been with you during the **past 4 weeks**. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the **past 4 weeks**...

	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
a) did you feel full of pep?	○	○	○	○	○	○
b) have you been a very nervous person?	○	○	○	○	○	○
c) have you felt so down in the dumps nothing could cheer you up?	○	○	○	○	○	○
d) have you felt calm and peaceful?	○	○	○	○	○	○
e) did you have a lot of energy?	○	○	○	○	○	○
f) have you felt downhearted and blue?	○	○	○	○	○	○
g) did you feel worn out?	○	○	○	○	○	○
h) have you been a happy person?	○	○	○	○	○	○
i) did you feel tired?	○	○	○	○	○	○

10. During the **past 4 weeks**, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
○	○	○	○	○

11. How TRUE or FALSE is each of the following statements for you?

	Definitely true	Mostly true	Don't know	Mostly false	Definitely false
a) I seem to get sick a little easier than other people	○	○	○	○	○
b) I am as healthy as anybody I know	○	○	○	○	○
c) I expect my health to get worse	○	○	○	○	○
d) My health is excellent	○	○	○	○	○

***THANK YOU* FOR COMPLETING THIS QUESTIONNAIRE!**

APPENDIX B

BODY IMAGE QUESTIONNAIRE

BODY IMAGE QUESTIONNAIRE

Thank you for taking the time to complete this important questionnaire. Please mark the appropriate box on our questionnaire with a number two pencil. If you need to change an answer, please make sure that your incorrect answer is completely erased. Thank you again for your help.

Beth Lanning, Ph.D., CHES
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(254) 710-4027
Beth_Lanning@baylor.edu

Please complete the following demographic information:

1. Age

____

2. Gender

☐ Male
☐ Female

3. Ethnicity

☐ Caucasian American
☐ African American
☐ Hispanic American
☐ Asian American
☐ Other

4. How many times per week do you engage in physical activity for at least 30 minutes?

☐ One time
☐ 2-3 times
☐ 4-5 times
☐ 6-7 times
☐ None

5. Fill in the box that you feel best represents your present physical fitness level:

☐ poor
☐ below average
☐ average
☐ above average
☐ excellent

Below is a list of statements dealing with your general feelings about yourself. If you strongly agree, fill in the bubble to the left of SA. If you agree with the statement, fill in the bubble to the left of A. If you disagree, fill in the bubble to the left of D. If you strongly disagree, fill in the bubble to the left of SD.

1. On the whole, I am satisfied with myself.	☐ SA	☐ A	☐ D	☐ SD
2. At times I think I am no good at all.	☐ SA	☐ A	☐ D	☐ SD
3. I feel that I have a number of good qualities.	☐ SA	☐ A	☐ D	☐ SD
4. I am able to do things as well as most people.	☐ SA	☐ A	☐ D	☐ SD
5. I feel that I do not have much to be proud of.	☐ SA	☐ A	☐ D	☐ SD
6. I certainly feel useless at times.	☐ SA	☐ A	☐ D	☐ SD
7. I feel that I am a person of worth, at least on an equal plane with others.	☐ SA	☐ A	☐ D	☐ SD
8. I wish I could have more respect for myself.	☐ SA	☐ A	☐ D	☐ SD
9. All in all, I am inclined to feel that I am a failure.	☐ SA	☐ A	☐ D	☐ SD
10. I take a positive attitude toward myself	☐ SA	☐ A	☐ D	☐SD

Please answer the following questions as accurately as you possibly can. For each item, indicate the degree to which the statement is characteristic or true of you. Fill in the bubble below the statement on the five point scale that best represents your response to each item.

KEY: 1=not at all true 2=slightly true 3=moderately true 4=very true 5=extremely true

	1	2	3	4	5
11. I am comfortable with the appearance of my physique/figure.	☐	☐	☐	☐	☐
12. I would never worry about wearing clothes that might make me look too thin or overweight.	☐	☐	☐	☐	☐
13. I wish I wasn't so uptight about my physique/figure.	☐	☐	☐	☐	☐
14. There are times when I am bothered by thoughts that other people are evaluating my weight or muscular development.	☐	☐	☐	☐	☐
15. When I look in the mirror, I feel good about my physique/figure.	☐	☐	☐	☐	☐
16. Unattractive features of my body/figure make me nervous in certain social situations.	☐	☐	☐	☐	☐
17. In the presence of others, I feel nervous about my body/figure.	☐	☐	☐	☐	☐
18. I am comfortable with how fit my body appears to others.	☐	☐	☐	☐	☐
19. It would make me uncomfortable to know that others were judging my body/figure.	☐	☐	☐	☐	☐
20. When it comes to showing my body/figure to others, I am a shy person.	☐	☐	☐	☐	☐
21. I usually feel relaxed when it is obvious that others are looking at my body/figure.	☐	☐	☐	☐	☐

22. When in a bathing suit, I often feel nervous about the shape of my body.	☐	☐	☐	☐	☐

Please indicate the degree to which you agree with the following statements:
1=Definitely Disagree 2=Mostly Disagree 3=Neither Agree or Disagree 4=Mostly Agree 5=Definitely Agree

	1	2	3	4	5
23. Before going out in public, I always notice how I look.	☐	☐	☐	☐	☐
24. I am careful to buy clothes that will make me look my best.	☐	☐	☐	☐	☐
25. My body is attractive.	☐	☐	☐	☐	☐
26. I constantly worry about being or becoming fat.	☐	☐	☐	☐	☐
27. I like my looks just the way they are.	☐	☐	☐	☐	☐
28. I check my appearance in a mirror whenever I can.	☐	☐	☐	☐	☐
29. Before going out, I usually spend a lot of time getting ready.	☐	☐	☐	☐	☐
30. I am very conscious of even small changes in my weight.	☐	☐	☐	☐	☐
31. Most people would consider me good-looking.	☐	☐	☐	☐	☐
32. It is important that I always look good.	☐	☐	☐	☐	☐
33. I use very few grooming (hair, face) products.	☐	☐	☐	☐	☐
34. I like the way I look without my clothes on.	☐	☐	☐	☐	☐
35. I am self-conscious if my grooming (hair, face, clothing) isn't right.	☐	☐	☐	☐	☐
36. I usually wear whatever is handy without caring how it looks.	☐	☐	☐	☐	☐
37. I like the way my clothes fit me.	☐	☐	☐	☐	☐
38. I don't care what people think about my appearance.	☐	☐	☐	☐	☐
39. I take special care with my hair grooming.	☐	☐	☐	☐	☐
40. I dislike my physique/body.	☐	☐	☐	☐	☐
41. I am physically unattractive.	☐	☐	☐	☐	☐
42. I never think about my appearance.	☐	☐	☐	☐	☐

43. I am always trying to improve my physical appearance	☐	☐	☐	☐	☐
44. I am on a weight-loss diet.	☐	☐	☐	☐	☐

For the remainder of the items, use the response scale given with the item, and fill in the bubble beside the answer.

45. I have tried to lose weight by fasting or going on crash diets.

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Very Often

46. I think I am:

☐ Very Underweight
☐ Somewhat Underweight
☐ Normal Weight
☐ Somewhat Overweight
☐ Very Overweight

47. From looking at me, most other people would think I am:

☐ Very Underweight
☐ Somewhat Underweight
☐ Normal Weight
☐ Somewhat Overweight
☐ Very Overweight

26-34. Use this scale to indicate how dissatisfied or satisfied you are with each of the following areas of aspects of your body.

1=Very Dissatisfied 2=Mostly Dissatisfied 3=Neither Satisfied nor Dissatisfied 4=Mostly Satisfied 5=Very Satisfied

	1	2	3	4	5
48. Face (facial features, complexion)	☐	☐	☐	☐	☐
49. Hair (color, thickness, texture)	☐	☐	☐	☐	☐
50. Lower torso (buttocks, hips, thighs, legs)	☐	☐	☐	☐	☐
51. Mid torso (waist, stomach)	☐	☐	☐	☐	☐
52. Upper torso (chest or breasts, shoulders arms)	☐	☐	☐	☐	☐
53. Muscle tone	☐	☐	☐	☐	☐
54. Weight	☐	☐	☐	☐	☐

55. Height	☐	☐	☐	☐	☐
56. Overall appearance	☐	☐	☐	☐	☐