Hunger and Satiety in Recovering Eating Disorder Patients

Jenelle T. West

Utah State University

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HUNGER AND SATIETY IN RECOVERING EATING DISORDER PATIENTS

by

Jenelle T. West

A project report submitted in partial fulfillment of the requirements for the degree of

MASTER OF DIETETIC ADMINISTRATION

In

Nutrition and Food Sciences

Approved:

UTAH STATE UNIVERSITY
Logan, Utah

2005
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ABSTRACT

Hunger and Satiety in Recovering Eating Disorder Patients

by

Jenelle T. West, Master of Science
Utah State University, 2005

Major Professor: Kim McMahon
Department: Nutrition and Food Sciences

Desire to eat, hunger, feeling of having enough to eat, and fullness were measured in 11 eating disorder patients in treatment for less than two months, 7 eating disorder patients in treatment for more than two months, and 11 controls. The experimental group was female patients with a DSM-IV diagnosis of Anorexia Nervosa, Bulimia Nervosa, or eating disorder not-otherwise-specified. The experimental and control groups ate a test meal two hours after a preload. The groups answered four questions about desire to eat, hunger, feeling of having enough to eat, and fullness, before they ate, halfway through their meal, immediately upon finishing the meal, and 15 minutes after finishing their meal. The groups were required to eat 100% of the meal provided. The difference in data between the experimental and control groups was not statistically significant. The experimental group that had been in treatment longer than two months had means closer to the control group than the other experimental group who had been in treatment less than two months. This may suggest that the experimental group who had been in treatment more than two months was starting to regain a more normal sense of hunger and satiety. However, a repeat study with a larger sample size would be needed to prove that statement.

(63 pages)
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I would also like to thank the Center for Change for donating the food used in the study.

I give a special thanks to Chad Dawson and Roxane Pfister who helped me analyze the statistical data for this study.

Jenelle T. West
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Analysis comparing 4 experimental groups and 1 control group

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INTRODUCTION

According to the Diagnostic and Statistical Manual of Mental Disorders (1) Anorexia Nervosa is characterized by a refusal to maintain body weight at or above a minimally normal weight for age and height. Anorexics, although underweight, fear gaining weight or becoming fat. This distorted perspective of their body weight and shape, often leads them to experience denial of their condition. Female anorexics are characterized by the absence of at least three consecutive menstrual cycles (1).

Bulimia nervosa is characterized by recurrent episodes of binge eating or eating within any two-hour period any amount of food that is definitely larger than the average person would consume during a similar period of time according to the Diagnostic and Statistical Manual of Mental Disorders (1). Bulimics lack control over eating during a binge episode and participate in recurrent, inappropriate, and compensatory behavior in order to prevent weight gain. This behavior is often characterized by activities such as self-induced vomiting, misuse of laxatives, diuretics, enemas, or other medications, fasting, or excessive exercise. Bulimics must participate in binge eating and compensatory behaviors for at least twice a week for three months in order to be considered bulimic (1).

For reasons of clarity, the control groups discussed throughout this thesis, in the literature review and in my study, represent a non-eating disorder population with assumably normal hunger and satiation.

Many studies indicate that in addition to disordered eating, people suffering from eating disorders acquire distorted hunger and satiety. Despite lower intakes than controls, anorexics often report less desire to eat before and after eating and a greater satiation
after eating than controls (2,3,4,5,6). Bulimics show lower satiety as compared to controls and eat significantly more than controls in some studies (2,4,7,8,9). Bulimics have also been observed to eat significantly less than controls when they feel they have no opportunity to purge after a meal (7,9). One study found that bulimic’s hunger ratings before a non-purged meal were lower than before a purged meal (7). Another study states that when bulimics binge-eat their sense of hunger and satiety diminishes, and to compensate for when they are non-binge-eating they consciously under-consume to make up for a disturbance in the normal development of satiety during a meal (9).

Several reasons could indicate why eating disorder patients report distorted hunger and satiety; however, no study indicates whether or not they can re-learn normal hunger and satiety senses during time in treatment.

Because research does not indicate that eating disorder patients can re-learn to sense hunger and satiety, the purpose of this research project was to determine if eating disorder patients start to or fully recover an accurate sense of hunger and satiety throughout time in a treatment program.
Diagnoses of Eating Disorders

Anorexia Nervosa, Bulimia Nervosa, and Eating Disorder Not Otherwise Specified (NOS) diagnostic criteria come from the Diagnostic and Statistical Manual of Mental Disorders (1).

Anorexia Nervosa is characterized by a refusal to maintain a minimally normal body weight, fear of gaining weight, and distorted perceptions of body shape. To be considered anorexic the person must weigh less than 85% of the weight that is considered normal for their age and height. Weight loss is accomplished by reducing overall intake or through excluding certain foods, usually high calorie foods; the individual usually ends up with a severely restricted diet only containing a few foods (1).

Another criterion for Anorexia Nervosa is the absence of three consecutive menstrual cycles. This is due to abnormally low levels of estrogen because of lack of secretion of follicle-stimulating hormone and luteinizing hormone due to starvation (1).

There are two subtypes of Anorexia Nervosa; restricting type and binge-eating/purging type. When individuals engage in weight loss through dieting, fasting, or excessive exercise it is considered restricting type. Binge-eating/purging type is characterized by using binge eating or purging (or both) during a current episode (1).

Anorexia is most prevalent in industrialized societies where there is an abundance of food and where being thin is considered attractive. 0.5%-1% of females in late adolescence and early adulthood meet the criteria for Anorexia Nervosa. Many individuals are on the subthreshold of this disorder and are categorized in the eating
disorder NOS group. More than 90% of anorexics are female (1). The mean age at onset is 17 years, and rarely occurs over age 40 (1). Some individuals recover fully after a single episode, and some fluctuate with weight gain and relapse over the course of many years. Long-term mortality for anorexia is over 10%. Death occurs due to starvation, suicide, or electrolyte imbalance (1).

Bulimia Nervosa is characterized by binge eating and inappropriate compensatory methods to prevent weight gain. A binge is defined as eating, in a discrete period of time, an amount of food that is definitely larger than most individuals would eat under similar circumstances. Binge foods typically include sweet, high-calorie foods, however, binge eating is characterized more by the amount of food consumed than the actual food. Binge eating usually occurs in secrecy and may or may not be planned in advance. Triggers for binge eating include stress, intense hunger due to restriction, or feelings related to weight, body size, and food (1).

Two more criteria for bulimia include: sense of lack of control when binge eating, and recurrent use of inappropriate compensatory behavior to prevent weight gain. The most common compensatory behavior is vomiting after an episode. Other behaviors include misuse of laxatives and diuretics, enemas, fasting for a day or more, or excessive exercise to compensate for binge eating (1).

Bulimics use body shape and weight to determine self-esteem. This closely resembles anorexia in their fear of gaining weight, in their desire to lose weight, and in the level of dissatisfaction with their bodies (1).

There are two subtypes of Bulimia Nervosa; purging type and nonpurging type. Purging type is characterized by a person engaging in vomiting or misuse of laxatives,
diuretics or enemas during an episode. Nonpurging type is characterized by a person using fasting or exercise and not other compensatory methods during a current episode (1).

Typically bulimics are within a normal weight range. Between binges, bulimics usually restrict their total calorie intake and select low-calorie foods and avoid fattening foods that will likely trigger a binge (1).

Bulimia Nervosa occurs in most industrialized countries and at least 90% of bulimics are female (1). Bulimia Nervosa occurs in approximately 1%-3% of young adult females (1). Bulimia usually sets in late adolescence or early adulthood. In most cases, disturbed eating occurs for several years and the long-term outcome of bulimia is unknown (1).

Eating disorder NOS is the category used for disorders that do not meet the exact criteria for anorexia or bulimia (1).

Gastric Signals of Hunger and Satiety

It is assumed that people start eating when they get hungry or when their stomachs are empty, however, Graff, et al (10) discusses other internal signals that may affect appetite and hunger. This study found that when blood glucose concentrations decline within a short time frame (five minutes) it is strongly correlated with meal initiation, or when blood glucose decline, hunger increases.

Graff, et al (10) also found that leptin relates to hunger. Leptin is synthesized mainly by adipose tissue and provides information on the availability of body fat stores to the hypothalamus. In general, leptin concentrations do not change within three to four
hours in response to meals. It does not act as a short-term signal, however, it does act as a long-term signal relating to appetite, and if a person were restricting caloric intake for a few days leptin would play a role in increasing appetite. Leptin is not useful as a biomarker of short-term signal of hunger.

Ghrelin is the last internal signal discussed by Graff, et al (10) for hunger. The study found that ghrelin can act as both a short term and a long term biomarker for hunger. Ghrelin is synthesized in the fundus of the stomach and its concentrations decline quickly after meals, returning to premeal concentrations before the next meal is initiated. It has a stimulating effect on appetite and it is proposed that because ghrelin is a peripheral hormone that acts on the hypothalamus, it plays a role in the satiety cascade. Ghrelin stimulates hunger and can be used as a measurable signal of hunger (10).

According to Mook et al. and Tuomisto et al. (11, 12) people stop eating due to a sensation of fullness in the stomach and the pleasantness of food being eaten has declined. Meal termination due to the sensation of fullness and the reduction in pleasantness of food depends on short-term signals such as stomach distension and on gut hormones, cholecystokinin (CCK) and glucagons-like peptide -1 (GLP-1) (10).

CCK is released in the blood as a function of the presence of long-chain fatty acids or protein in the duodenum (13). CCK suppresses appetite by effecting pyloric pressure, stomach motility, and stomach muscle relaxation, causing a delay in gastric emptying and subsequent increase in gastric distention. Gastric distention is likely to be a causal factor in the chain of events leading to meal termination or satiation. CCK is a measurable signal for satiety.
GLP-1 is produced primarily in the ileum in response to the presence of nutrients, ie, carbohydrates and fat. GLP-1 stimulates the pancreas to secrete insulin, thereby contributing to the lowering of blood glucose concentrations (14). GLP-1 helps moderate the digestive flow of food from the stomach into the small intestine delaying gastric emptying and subsequently increasing gastric distention much like CCK. This is the mechanism by which GLP-1 effects satiation (15). GLP-1 can also be used as a measurable signal for satiety.

Some research has shown that Anorexia Nervosa and Bulimia Nervosa patients have distorted hunger and satiety due to delayed gastric emptying and low levels of CCK respectively.

Robinson (16) found that a possible reason that anorexic patients report low hunger and prolonged satiety after meals is due to delayed gastric emptying. Anorexics, bulimics, and controls ate test meals and had the gastric contents measured with gastric scintigraphy. Gastric emptying of the solid meal was significantly slower in anorexic patients compared to controls and patients with bulimia. Delayed gastric emptying was only observed in patients who were suffering from starvation, either due to food restriction or vomiting. The study suggested that the food restriction was the major determinant of delayed gastric emptying. Robinson (16) hypothesized that the pathogenesis behind the delayed gastric emptying might involve alterations in gastric sensitivity to duodenal caloric or osmotic stimuli.

This suggests that the delayed emptying in anorexics does not antedate the onset of Anorexia Nervosa, but is a consequence of the nutritional disturbance. Once a pattern of starvation has been established, gastric slowing may lead into a cycle of restriction by
producing enhanced satiety and prolonged intervals between meals thereby contributing to a reduced food intake. This may act as a perpetuating factor in Anorexia Nervosa (16).

Geracioti et al. (17) found that patients suffering from Bulimia Nervosa have impaired CCK release. Most patients with bulimia have strong appetites, craving for food, and difficulty knowing when they are full at the end of a meal, suggesting an impairment of satiety. CCK as discussed previously delays gastric emptying and leads to satiety. In this study patient with Bulimia Nervosa had significantly lower plasma CCK after eating as compared to controls. Basal CCK levels before eating were similar in both bulimics and controls, however, twenty minutes after the subjects had eaten the controls had significantly higher levels of CCK. The bulimic patients had a lower peak level of CCK immediately after the meal and also a low total secretion of the hormone. This could be the reason that bulimic patients experience impaired satiety after eating (17).

It can be assumed that both delayed gastric emptying in Anorexia Nervosa and impaired CCK levels in Bulimia Nervosa could be normalized by normal patterns of eating over time. This may fit with the researcher’s hypothesis that eating disorder patients can relearn or regain accurate hunger and satiety senses through time in treatment because treatment provides both normalized eating patterns and time for the nutrition stores, hormones, and hunger/satiety senses to return to normal.

Visual Analog Scales

In the literature review and also in the researchers study visual analog scales (VAS) were used. The most common way to study hunger and satiety is by using subjective VAS. This is most popular because it does not require expensive or time-
consuming measures to get results. The VAS is anchored by two extremes, usually on a 100 or 150 mm line, and most commonly measure hunger, fullness, and desire to eat (2,3,4,5,6,7,8). This is not the most accurate or the only way to measure hunger and satiety. Many studies include mood and sensory quality of food questions as a factor of hunger and satiety, such as fear of becoming fat, guilt, depression, contentment, pleasantness, appearance, odor, and taste (2,3,4,7).

The most accurate way to measure hunger and satiety is by using VAS scales along with measuring gastric emptying (3,18). This measurement is able to show the contents in the stomach and how quickly the stomach is emptying through scintigraphy. This allows the researcher to measure the difference between stomach contents and the reported hunger and satiety.

Research Studies

The review of literature includes studies conducted with Anorexia Nervosa, Bulimia Nervosa, and eating disorder NOS patients and discusses the inability of these patients to accurately sense hunger and satiety.

Rolls et al. (7) tested responses to yogurt preloads differing in carbohydrate and fat versus a lower energy control yogurt to see if bulimics reported blunted satiety. The study participants included 12 bulimics and 12 age- and weight-matched controls. Participants were tested three times during the lunch hour. Appetite and mood were rated using VAS on eight occasions during each test meal. A visual analog scale is usually a 100 mm or 150 mm line anchored at each end of the line by the extremes i.e. not at all hungry and extremely hungry. The scales were filled out before and after the preload,
before and after dinner, and every 60 minutes between the preload and dinner. This study found that bulimics reported blunted satiety, but that it is not due to high-fat or high-carbohydrate preloads but something undefined. The results showed that in conditions where purging is discouraged or prevented, bulimics eat significantly less than controls (7).

In a similar study, Rolls et al. (2), used different energy preloads to determine if eating disorder patients compensated food intake appropriately with differing energy intakes. Subjects in the study included female patients: anorexics with bulimic features, bulimics, or non-patient normal-weight non-dieters. Low- and high-energy salads were used as preloads followed by an ad libitum test meal. Subjects rated their hunger, thirst, desire to purge, guiltiness, fear of becoming fat, and depression on a 100-mm VAS. The questionnaires were filled out before and after preloads and before and after the test meal. Subjects participated in three lunchtime sessions.

This study found that overall bulimics ate more than the anorexic or control groups, while the anorexics with bulimic features ate less than control and bulimic groups. This study hypothesized that the groups would counter regulate the amount they ate at the test meal in correlation with the amount ate at the preload. However, the study concluded that the bulimics showed no counter regulation with different size preloads. The bulimics demonstrated the same rating of hunger before the preload as controls did but showed only a small change in hunger after the preloads and before the test meal. This response was unlike that observed for controls which showed a larger change in hunger after the preloads and before the test meal. Anorexics reported low hunger before eating and showed some decrease in hunger with eating but this was a relatively small
change compared with the bulimic and control groups, most likely due to the low initial hunger. The study stated that it wasn’t clear whether anorexics deny hunger or are unable to experience hunger (2).

The outcome of a study conducted by Hetherington and Rolls (4) was similar to the last; the results from the different eating disorder subgroups were similar. The aim of this study was to investigate patient’s view of hunger, appetite, and satiety with an assessment of some objective parameters of energy intake, macronutrient selection, and food choice in eating disorder patients. The study involved anorexics, bulimics, normal weight dieters, overweight dieters, and normal weight non-dieters. The patients participated in test meals three times with a different caloric preload each time. A VAS was given at each test meal for hunger, thirst, fullness, desire to eat, prospective consumption, fear of becoming fat, and depression. After the preload the patient filled out a VAS at 2, 20, 40, and 60 minutes. The patients then ate the test meal ad libitum (4).

The study showed that after all preloads, anorexics ate significantly less than bulimics and controls and anorexics rated hunger and desire to eat consistently lower and fullness greater than bulimics and controls. Bulimics in this study did not decrease their intake after a high-calorie preload like the anorexics and controls (4).

Unlike the previous studies mentioned, Robinson (3) combined VAS scales with simultaneous measures of gastric contents derived scintigraphically at different times after meals in patients with anorexia, bulimia, as well as a control groups. Gastric contents were measured to determine how closely the subjects’ ratings of hunger and satiety matched gastric emptying (3).
Subjects included 22 anorexics, 10 bulimics, and 10 controls. Patients ate the test meal and then stood with their abdomen wall to an IGE Maxicamera gamma camera for one minute while stomach contents were scanned. The scans were acquired every 5 to 10 minutes for 2 hours. 10 minutes before and after the test meal, subjects rated hunger and fullness on VAS questionnaires. These questions included ratings of gastric sensations, overall sensations, mood, urge to eat, and preoccupation with food. Two times before the meal and at each scan after the meal the patient rated their sensations on a VAS (3).

This study found that anorexics and bulimics were accurately able to report gastric contents in ratings of gastric fullness but their hunger related poorly to stomach fullness. Anorexic patients reported feeling less hungry and fuller than controls. The study suggested it is due to a disturbance in the interpretation of gastric signals coming from the GI tract, rather than in their perception. They believe that the gastric signals indicating hunger and satiety can be disassociated. In other words, eating disorder patients can still feel hunger and satiety sensations but struggle to accurately identify them (3).

Hadigan et al. (9) tried to determine satiety in binge and non-binge eating episodes in women with Bulimia Nervosa and normal controls. The study examined whether an increase in the size of a soup preload led to a decrease in the amount of food consumed in a subsequent test meal. Subjects had to successfully complete two screening meals before participating in the four test meals. Two of the test meals involved a small soup preload and two test meals were preceded by large soup preloads. On one of the small preload and one of the large preload meals, the patients were asked to
binge. On the other small and large preload meals the patients were asked not to binge. VAS questionnaires were given before and after the preload and again after the test meal before the patients had any opportunity to purge. Subjects rated hunger and fullness on a 150-mm VAS (9).

The study found that normal, non-dieting individuals eating a larger preload consistently produced greater changes in subjective ratings of satiety and a greater decrease in subsequent food consumption than a smaller preload. Bulimics consumed twice as much of the test meal than the controls, yet the changes in hunger ratings and fullness from baseline to immediately after the test meal were similar to, not greater than, those of the control group. This study found the slowing rate of consumption normally associated with the termination of a meal is diminished in the patient’s binge eating episodes. The study also found that some patients overly restricted intakes when not binge eating. The study concluded that bulimics have a disturbance in the development of satiety (9).

The next study by Halmi, Sunday (5) was designed to determine the dependence of eating disorder patients on external cues for deciding the amount of food to consume. Twenty-nine anorexic restrictors, 25 anorexic bulimics (anorexic purging-type), 30 normal weight bulimics, and 19 normal weight controls completed the study subjects. Patients tested within 10 days of admission to the hospital and re-tested again days before discharge (5).

The test meal was given at breakfast in the form of a liquid meal after a 10 hour overnight fast. Patients were instructed to eat ad libitum. Every 2 minutes subjects rated their hunger and fullness using a 100-mm line. Ratings started 8 minutes before the meal
and continued until 12 minutes following the meal. Subjects also answered three
questions concerning urge to eat, preoccupation with thoughts of food, and willpower
required to stop eating. The study included four testing sessions—two before and two
after treatment. During one test before and one test after treatment, the subject was
allowed to see the food reservoir. Subjects were not allowed to see the food reservoirs
during the test meals (5).

The study found that there was no significant difference in the amount consumed
between the covered and uncovered conditions. Anorexic restrictors had lower hunger
ratings and higher fullness ratings than controls. However, during the emaciated state,
those anorexics who admitted to feeling hungry and not full were the patients who
consumed the greatest amounts. This relationship was not present after weight
restoration, nor was it present in normal weight bulimics or controls. Normal weight
bulimics and anorexic-bulimics did not differ significantly from the controls in the
analysis of hunger and fullness; however, the hunger and fullness responses often
indicated a confusion of the perceptions of hunger and satiety. The study concluded that
eating disorder patients had predominantly abnormal patterns of hunger and fullness
curves when calculated, indicating the subjects had confused hunger and fullness signals;
which may be based on cognitive sets and external and internal cues (5).

In another study Sunday, Halmi (6) showed the disturbance in hunger and satiety
perceptions. The purpose behind this study was to observe normal, non-binging, meal
responses to several foods varying in macronutrient content and to examine the hunger
and satiety perceptions in acutely ill anorexic and bulimic patients, comparing them to a
control group. The subjects included 26 anorexic restrictors, 13 anorexics with bulimic
characteristics, 26 normal weight bulimics, 16 normal weight controls who restrict intake with no history of an eating disorder, and 19 normal women who were unrestrained eaters and had no history of an eating disorder. Subjects were given two test meals and instructed to eat the meal ad libitum. At 2 minute intervals beginning 10 minutes before the meal and continuing 14 minutes after the meal, patients rated hunger, satiety, and their urge to eat on a 100-mm line (6).

The study discovered that eating disorder patients differed from controls more in ratings of hunger than in fullness. Subjects also showed confusion concerning rating hunger and satiety. These confusion abnormalities were more easily seen with each individual response to hunger and satiety than when compared to the combined responses. The data from this study suggested the treatment of anorexia and bulimia nervosa should involve attention to hunger and satiety retraining to achieve normal hunger and satiety responses when eating (6).

Kissileff (8) focused solely on bulimic patients and showed a disturbance in satiety. The study determined whether patients with Bulimia Nervosa experience the development of satiety during a meal differently than control subjects. Eleven women with bulimia and 11 controls without bulimia consumed a shake meal after being instructed to binge. After each 75 gram increment of shake consumed, the subjects were asked to fill out a VAS for fullness, hunger, desire for a favorite food, pleasantness of the shake, sickness, and having enough to consume (8).

The study found that having subjects rate sensations after eating specific amounts of food during a meal could be a new tool for assessing the development of satiety and other feelings that accompany food consumption. This study also found that patients
with bulimia do not experience the same subjective perceptions of satiety during a meal as controls. The bulimics’ blunted development of satiety towards the end of the meal suggested that normalization of their satiety sensations in response to foods may be a behavioral validation of a patient’s progress toward recovery (8).

The research reviewed strongly supports that eating disorder patients have a distorted sense of hunger and satiety. Studies to examine if eating disorder patient’s can re-learn how to sense hunger and satiety during treatment would contribute to the body of this research. The researcher wanted to conduct research to show if eating disorder patients may re-learn or become in-tune again with their hunger/satiety cues and that with time in recovery their senses become more accurate.
DATA DESCRIPTION

Methodology

Similar to the majority of the research studies, the researcher in this study used a 100 mm visual analog scale to determine the patients’ ability to sense hunger and satiety. Anorexic, bulimic, and eating disorder NOS patients in a residential treatment center were asked to act as the experimental groups. A control group also participated in the study to provide a baseline measurement. The eating disorder patients tested in the study came from an eating disorder treatment center in Orem, UT, the Center for Change. The experimental group consisted of patients in treatment less than two months compared to patients in treatment more than two months. The control group consisted of direct-care staff at the Center for Change similar in age to the majority of the experimental group. Staff members at the Center for Change accompany eating disorder patients in therapy groups and classes, giving them a similar experience, in terms of program structure, as the eating disorder patients. Using staff members as a control group reduced the variances that could occur if a group who were unfamiliar with the program and/or its recovery procedures was chosen.

The target population for this research was female eating disorder patients ranging in age from 16 to 35 years of age who were treated at the Center for Change in Orem, UT. The control group was taken from a population of women ranging in age from 22-36 who work as care technicians at the Center for Change. Only females were used for the study, because previous research has used all female experimental groups and the Center for Change inpatient program is an all-female facility. The sample size for the study,
after unusable surveys were discarded, consisted of 11 controls, 11 patients in
treatment for less than two months, and 7 patients in treatment for more than two months.
Surveys were discarded due to participants who did not complete the survey or
participants who did not complete the survey at the correct times.

Before the study, all participants signed an informed consent form (Appendix A).
The predicted sample size was reduced significantly due to patients and controls that
elected not to participate. Because of the reduced sample size, the patients were
categorized into two groups: those in treatment for less than two months, and those in
treatment for more than two months. Volunteers in the control group were screened
through the Eating Attitudes Test (EAT-26) to detect symptoms of an eating disorder
(Appendix B).

Background information was collected on each participant, including height,
weight, body mass index, age, and prescribed medications. This information was
gathered from the medical records of the eating disorder patients and was self-reported by
the control group. Other information collected specifically from the experimental group
included time spent in the Center for Change program and DSM-IV criteria — to
determine their eating disorder diagnosis. Time spent in the program was the dependent
variable used to determine whether patients can re-learn to sense hunger and satiety
throughout time in a treatment program.

Similar to other studies, participants involved in the study consumed a preload
before the test meal. Unlike some other studies, the participants were instructed to fill
out a VAS before the test meal, halfway through the test meal, immediately following
the test meal, and fifteen minutes after finishing the test meal. By assessing hunger and
satiety at various points in the study, this provided additional points for assessment and the researcher could more accurately determine results, as was the case in the Kissileff et al. study (8).

The preload consisted of six ounces of Yoplait yogurt (180 calories, 1.5 grams of fat, 34 grams of carbohydrate, and 6 grams of protein). The preload helped standardize the stomach contents of each participant and thus increase the response comparison accuracy during the test meal. Each participant filled out a VAS questionnaire directly before and after the preload. This was also done to familiarize participants with the questionnaire that would be used during the test meal.

Participants were given 15 minutes to eat the preload. Two hours after completing the preload, the participants ate the test meal. The test meal consisted of 10.5 ounces of Stouffer's lasagna (370 calories, 14 grams of fat, 39 grams of carbohydrate, and 23 grams of protein). Both the preload and the test meal were combination foods containing carbohydrate, fat, and protein. The combination foods were used to decrease the chance of disproportionate macronutrient meal affecting satiation.

The participants had 30 minutes to eat the test meal. This time frame was used based on the Merrill et al. (19) study which found a 30 minute testing period may be as predictive of the satiety value of a given food as a 60 minute testing period.

This study used one meal to produce valid results. Appetite scores measured through a VAS can be reproduced and therefore are considered a valid study (20).

Participants plotted on a 1-100-mm line their questionnaire responses. Two of the questions were “How hungry are you?” and “How full are you?” anchored by “not at all” and “extremely.” The other two questions were “How strong is your desire to eat right
now?” and “How strongly do you feel that you’ve had enough to consume?” anchored by “very weak” and “very strong” (Appendix C). These VAS questions were based on previous studies using VAS to measure hunger and satiety (5,8,21). Although using VAS by itself is not the most accurate way to measure hunger and satiety the researcher used this method because scintigraphy was not a possibility.

Analysis of Data

The experimental groups and control group differed in some areas that may have affected the results of the study. A complete table showing these differences is listed in Appendix D. The control group as a whole was older and had more education than the experimental groups which could have affected cognition and the ability to recognize hunger/satiety signals. The younger patients in the experimental group could still be growing which can also affect hunger/satiety due to extra energy needed for the growth. The experimental group in treatment less than two months had a lower BMI range than the other two groups. This can affect hunger/satiety in individuals who are underweight due to the body requiring more food to regain weight to a normal level. The experimental groups had more medications than the control group, many of which could have some affect on appetite as was discussed in the limitations section. Both experimental groups had more bulimics than anorexics or eating disorder NOSs. The control group’s EAT scores were within a normal range.

After the test meal, completed questionnaires were analyzed using the ANOVA method to compare the control’s answers to that of the experimental groups’. Statistical analyses discovered the sample size in each of the groups was not large enough to
produce statistically significant results. The sample sizes included 11 controls, 11 eating disorder patients in treatment for less than two months, and seven eating disorder patients in treatment for more than two months.

Even though the differences observed between treatment and control groups were not statistically significant, the results in this study produced some observations that can lead to a more complete study of the topic in the future. The ANOVA plots for each question at each test time are given in Appendix E. The means and standard deviations for each group and each question are listed in Appendix F. The researcher took the data from Appendix F and made a line chart for each question comparing the mean responses from each group, each time the question was asked and will be discussed in the results section.

The differences between anorexics and bulimics were not statistically significant, ANOVA plots are listed in Appendix G and the means and standard deviations for each group are listed in Appendix H. The researcher also took the data from the ANOVA plots for this analysis and made line charts comparing the mean answers to each question that will be shown in the results section.

Limitations

The most evident limitation was the sample size used in the study. Because this study was cross-sectional, the researcher could only solicit the participation of eating disorder patients being treated at the Center for Change at the time of the study. A way to complete this study and obtain observational evidence would be to establish a longitudinal study in which each participant is given the same test meal and questionnaire
upon entering the Center for Change program and then giving the same test meal and questionnaire every consecutive month during treatment. In theory, after collecting information from a statistically significant population, this study could examine the trajectory of change in re-learning hunger and satiety cues and discover and support the timeline behind a patient’s ability to re-learn and to re-sense hunger/satiety.

Another limitation in this study was that the researcher was unable to divide the experimental groups according to their eating disorder diagnosis. The researcher did an analysis with the data splitting the experimental groups up into anorexics in treatment less than 2 months, bulimics in treatment less than 2 months, anorexics in treatment more than 2 months, bulimics in treatment more than 2 months, and controls, however, due to the small numbers in the groups the researcher was unable to find statistical significance or any patterns. The data analysis for these groupings will be shown in the results and appendix sections.

Again, a longitudinal study would benefit this study by allowing time to gather enough participants to divide the experimental group by diagnoses. Anorexics and bulimics, when compared against each other, could provide a more definite outcome, as was shown in the literature review, because both present potentially different views of hunger and satiation.

Another constraint presented in this study was the limited time segments. Instead of less than two months and greater than two months, the experimental group could be broken up into less than one month, one to two months, two to three months, and three to four months. This grouping would provide a more accurate sense of when eating
disorder patients start to regain their sense of hunger/satiation, if in fact patients can regain the sense. This would require a larger sample size.

The next limitation to the study was medication. Because nearly all of the patients treated at the Center for Change also suffer from other psychological disorders, the strong majority of them take an anti-depressant and/or anti-psychotic medication. One of the side effects of many of these medications is an increase or decrease in appetite. The researcher realizes this limitation will always exist in an inpatient, residential setting.

A limitation that may skew appetite reports is weight. Some patients in the study were underweight. An underweight person, when not numbed by the eating disorder, is more hungry than normal due to the extra energy required to gain weight. This physiological hunger will skew the results when trying to find how hunger/satiety is affected psychologically by the eating disorder in underweight patients.

Results

Figure 1 compares answers to the first question, “How strong is your desire to eat?” Figure 1 indicates both experimental groups report a lower desire to eat as compared to the control group. Excluding the first time the question was asked, the experimental group in treatment more than two months reported a slightly higher desire to eat than the experimental group in treatment less than two months.
Figure 1. Comparison of the means for answers to the question “How strong is your desire to eat?”

Figure 2 shows that experimental groups report a lower sense of hunger as compared to the control group. This graph shows that the experimental group in treatment more than two months reported a desire to eat more similar to that of the control group than the experimental group in treatment less than two months each time the question was asked.

Figure 2. Comparison of the means for answers to the question “How hungry are you?”
The experimental groups in Figure 3 reported a higher sense of feeling they had enough to eat as compared to the control group. The observations in this graph are similar to Figure 1 in that, excluding the first time the question was asked, the experimental group in treatment more than two months reported hunger more similar to the control group reports than the experimental group in treatment for less than two months.

![Figure 3. Comparison of the means for answers to the question “How strongly do you feel you have had enough to eat?”](image)

Figure 3. Comparison of the means for answers to the question “How strongly do you feel you have had enough to eat?”

Figure 4 indicates that the experimental groups reported feeling a higher level of fullness than the control group. Again, similar to Figure 1 and Figure 3, excluding the first time the question was asked, the experimental group in treatment more than two months reported that they had had enough to eat with scores more similar to the control group than the experimental group in treatment for less than two months.
Figure 4. Comparison of the means for answers to the question “How full are you?”

Figures 5-8 shows the mean answers to questions 1-4 respectively. The experimental groups are broken up into anorexics in treatment less than 2 months, bulimics in treatment less than 2 months, anorexics in treatment more than 2 months, bulimics in treatment more than 2 months, and controls. As you can see in the graphs below, the experimental groups show no repeating patterns that stand out compared to each other or the controls. However, the control group is set apart from the eating disorder patients similar to what was shown above in figures 1-4.

Figure 5. Comparison of the means for the answers to the question “How strong is your desire to eat?”
Figure 6. Comparison of the means for the answers to the question “How hungry are you?”

Figure 7. Comparison of the means for the answers to the question “How strongly do you feel you have had enough to eat?”

Figure 8. Comparison of the means for the answers to the question “How full are you?”
CONCLUSIONS AND DISCUSSION

The results showed eating disorder patients have less of a desire to eat, a higher sense of having enough to eat, and report a higher level of fullness, as well as a lower level of hunger as compared to controls. The experimental groups showed observations comparable to results from previous studies dealing with hunger/satiety in anorexics and in bulimics who do not have the opportunity to purge (2,3,4,5,6,7,9). The results presented here are commensurate with findings from previous studies.

When comparing the experimental groups, one reason that more of a difference between them was not observed may be due to the fact that anorexics and bulimics were together instead of separated in the experimental groups. Anorexics have a tendency to report lower hunger and higher fullness than controls and bulimics. Bulimics who do not have the opportunity to purge report more normal levels of hunger but get full more quickly than controls. Because of this difference in anorexics and bulimics, combining their reported levels of hunger and fullness could have masked the true results of the study. When separating the anorexics and bulimics out to see if there was more of a pattern it did not show more specific results most likely due to such small sample sizes of 2-5.

The experimental groups followed a similar pattern in three out of the four questions. The group in treatment more than two months was more closely related to the control group than the group in treatment less than two months, except for the first time the question was asked on three out of the four questions. One possibility for this incongruence may be due to the fact that the group in treatment less than two months had more underweight participants who, as discussed previously, have higher energy needs.
than normal weight participants. This could have influenced their answers before they started eating because they were feeling more hunger. Hypothetically after starting to eat, this group started reporting less of a desire to eat, more of a desire to stop eating, and higher fullness than other groups due to their disassociation from gastric signals due to the disorder; which in theory, their disassociation would be more severe than the group in treatment for more than two months.

Even though the observations indicating a patient’s hunger/satiety was more closely related between the control group and patients in treatment more than two months, the researcher is unable to determine statistically whether hunger/satiety are being re-learned or re-gained in treatment. However, based on this trend in this study and others the researcher proposes the possibility of significantly validating this data. To solidify and accurately measure this observation further, the researcher believes more participants and a longitudinal study are needed to find the connection between how patients sense their hunger/satiety, length of treatment for their eating disorder, and regaining the hunger/satiety sense.
References


Appendices
Appendix A. Informed Consent
Informed Consent
Hunger and Satiety

Introduction
Jenelle West, a student at Utah State University is conducting a research study to find out more about hunger and satiety in the eating disorder population. You have been asked to participate because you or your child is in recovery for an eating disorder at the Center for Change.

Procedures
If you agree to be in this study, you (your child), will participate in eating a snack and a meal at the Center for Change. Before, during, and after the snack and meal, you (your child), will be asked to fill out a questionnaire dealing with hunger and satiety. Time spent participating in this study will be 15 minutes before and after the snack, and 15 minutes before and after the meal as well as the time needed to eat the snack and meal.

Risks
There is minimal risk that any background information about you (your child) will be lost or seen by others. Coding with numbers will be used to protect your (your child’s) information from being tied back to you (your child). Background information that may be collected for the study is age, height, weight, and/or current medications.

Benefits
There may not be any direct benefit to you (your child) from the study. However, the investigator may learn more about hunger and satiety in relation to eating disorders. This information could hopefully then be used to improve dietary treatment programs, not only at the Center for Change, but also at many other treatment facilities. This study may also collect knowledge to perpetuate further research about understanding how an eating disorder patient senses hunger and satiety.

Explanation & offer to answer questions
If you have any questions regarding this study you may contact Jenelle West at (801) 787-5412.
Participation in research is completely voluntary. You (your child) may refuse to participate or withdraw at any time without any consequence to you (your child). Participating or not participating in this study will not affect your (your child’s) recovery program at the Center for Change. You (your child) may also be withdrawn from the study by the principle investigator without your consent at any time due to: age, height, weight, and/or current medication that do not fit within the study’s guidelines or you do not complete the study questionnaire at each of the indicated times.

Research records will be kept confidential, consistent with federal and state regulation. Only the investigator will have access to the data collected, and it will be kept in a locked file. The data will be kept for three months and then destroyed.

The Institutional Review Board (IRB) for the protection of human participants at Utah State University (USU) has reviewed and approved this research study as well as the research board at the Center for Change. If you have any questions about your rights you may contact USU’s IRB office at (435) 797-1821

You have been given two copies of this Informed Consent. Please sign both copies and retain one copy for your files and return the other to:
Center for Change c/o Jenelle West
1790 State Street
Orem, UT 84057

“I certify that the research study has been explained to the individual, by me or my research staff, and that the individual understands the nature and purpose, the possible risks and benefits associated with taking part in this research study. Any questions that have been raised have been answered.”
Informed Consent
Hunger and Satiety

Date Created: January 18, 2005

Signature of PI & CoI
Noreen Schvaneveldt
Principle Investigator
(435) 797-2015

Jenelle West
Co-Investigator
(801) 787-5412

Signature of Subjects
By signing below I agree to participate:

Subjects Signature
Date

Duly Authorized Representative
Guardian Signature
Date

Relationship to patient

Youth Assent
I understand that my parent(s)/guardian is/are aware of this research study and that permission has been given for me to participate. I understand that it is up to me to decide to participate even if my parents say yes. If I do not want to be in this study, I do not have to and no one will be upset if I don’t want to participate or if I change my mind later and want to stop. I can ask questions that I have about this study now or later. By signing below, I agree to participate.

Name
Date
Appendix B. Eating Attitudes Test
### Eating Attitudes Test


<table>
<thead>
<tr>
<th>Age</th>
<th>Height</th>
<th>Current Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Current Medications**

---

**Please Circle a response for each of the following statements:**

<table>
<thead>
<tr>
<th>Question</th>
<th>Always</th>
<th>Usually</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Am terrified about being overweight</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2. Avoid eating when I am hungry</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3. Find myself preoccupied with food</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4. Have gone on eating binges where I feel I may not be able to stop</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5. Cut my food into small pieces</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6. Aware of the calorie content of foods I eat</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7. Particularly avoid food with a high carbohydrate content</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8. Feel that others would prefer if I ate more</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9. Vomit after I have eaten</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10. Feel extremely guilty after eating</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11. Am preoccupied with a desire to be thinner</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12. Think about burning up calories when I exercise</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>13. Other people think I’m too thin</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>14. Am preoccupied with the thought of having fat on my body</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15. Take longer than others to eat my meals</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16. Avoid foods with sugar in them</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>17. Eat diet foods</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>18. Feel that food controls my life</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>19. Display self-control around food</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20. Feel that others pressure me to eat</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>21. Give too much time and thought to food</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>22</td>
<td>Feel uncomfortable after eating sweets</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>23</td>
<td>Engage in dieting behavior</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>24</td>
<td>Like my stomach to be empty</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>Have the impulse to vomit after meals</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>Enjoy trying new rich foods</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

**Please respond to each of the following questions:**

1. Have you gone on eating binges where you feel that you may not be able to stop?
   If yes, on average, how many times per month in the last 6 months?

2. Have you ever made yourself sick (vomited) to control your weight or shape?
   If yes, on average, how many times per month in the last 6 months?

3. Have you ever used laxatives, diet pills or diuretics to control your weight or shape?
   If yes, on average, how many times per month in the last 6 months?

4. Have you ever been treated for an eating disorder?
   If yes, when?

5. Have you recently thought of or attempted suicide?
   If yes, when?
Appendix C. Hunger/Satiety Questionnaire
Hunger/Satiety Questionnaire

Please respond to the following questions by marking along the line the area that best describes how you feel:

How strong is your desire to eat?

Very
Weak

How hungry are you?

Not at all

How strongly do you feel that you have had enough to eat?

Very
Weak

How full are you?

Not at all

Extremely
Appendix D: Descriptive table of characteristics comparing experimental and control groups
<table>
<thead>
<tr>
<th>Table of descriptive characteristics</th>
<th>&lt; 2 months treatment n=11</th>
<th>&gt; 2 months treatment n=7</th>
<th>Control n=11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>16-35 Mean = 22.8</td>
<td>17-24 Mean = 20.4</td>
<td>22-36 Mean = 26.4</td>
</tr>
<tr>
<td>BMI</td>
<td>17-27 Mean = 20.7</td>
<td>19-28 Mean = 21.9</td>
<td>19-28 Mean = 22.5</td>
</tr>
<tr>
<td>Education</td>
<td>Some high school education to college degree</td>
<td>Some high school education to college degree</td>
<td>Some college education to college degree</td>
</tr>
<tr>
<td>Medications</td>
<td>Prozac, zyprexa, xanax, lupron, wellbutrin, resperdol, reglan, imitrex, lamictal, luvox, seroquel, fluoxetine, prevacid, birth control, strattera, colace, clonidine, protonix, ambien, ativan, nexion, zelnorm, cymbalta, aciphex, efudex, trazadone, paxil</td>
<td>Fosamax, yasmin BCP, depakote, seroquel, celexa, concerta, neurontin, trileptal, xanax, restoril, zyprexa, prozac, raglan, minocycline, allegra, wellbutrin, navane, zoloft</td>
<td>birth control, zoloft</td>
</tr>
<tr>
<td>Anorexics, Bulimics, NOS</td>
<td>AN -4</td>
<td>AN - 2</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>BN - 5</td>
<td>BN - 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NOS - 2</td>
<td>NOS - 2</td>
<td></td>
</tr>
<tr>
<td>Eat test score</td>
<td>N/A</td>
<td>N/A</td>
<td>0-5</td>
</tr>
</tbody>
</table>
Appendix E. ANOVA plots for each question at each test time for patients in treatment less than 2 months, patients in treatment more than 2 months, and controls
Figure E.1 Before eating, question 1

Figure E.2 Halfway through eating, question 1

Figure E.3 Done eating, question 1

Figure E.4 Fifteen minutes after finished eating, question 1
Oneway Analysis of beq2 By Group

Figure E.5 Before eating, question 2

Oneway Analysis of hwoq2 By Group

Figure E.6 Halfway through eating, question 2

Oneway Analysis of deq2 By Group

Figure E.7 Done eating, question 2

Oneway Analysis of ftoq2 By Group

Figure E.8 Fifteen minutes after finished, question 2
Figure E.9 Before eating, question 3

Figure E.10 Halfway through eating, question 3

Figure E.11 Done eating, question 3

Figure E.12 Fifteen minutes after finished, question 3
Figure E.13 Before eating, question 4

Figure E.14 Halfway through eating, question 4

Figure E.15 Done eating, question 4

Figure E.16 Fifteen minutes after finished, question 4
Appendix F. Descriptive Statistics for patients in treatment less than 2 months, patients in treatment for more than 2 months, and controls
<table>
<thead>
<tr>
<th>Group</th>
<th>Statistic</th>
<th>beq1</th>
<th>hwq1</th>
<th>deq1</th>
<th>ftq1</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (&lt; 2 months treatment)</td>
<td>Mean</td>
<td>54.5</td>
<td>30.2</td>
<td>19.0</td>
<td>19.3</td>
</tr>
<tr>
<td>n=11</td>
<td>Standard Deviation</td>
<td>17.1</td>
<td>23.1</td>
<td>19.8</td>
<td>19.0</td>
</tr>
<tr>
<td>B (&gt; 2 months treatment)</td>
<td>Mean</td>
<td>40.4</td>
<td>42.3</td>
<td>21.6</td>
<td>25.3</td>
</tr>
<tr>
<td>n=7</td>
<td>Standard Deviation</td>
<td>21.5</td>
<td>22.6</td>
<td>20.5</td>
<td>24.4</td>
</tr>
<tr>
<td>C (control)</td>
<td>Mean</td>
<td>78.1</td>
<td>60.5</td>
<td>37.7</td>
<td>45.4</td>
</tr>
<tr>
<td>n=11</td>
<td>Standard Deviation</td>
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be = Before eating
hw = Halfway through eating
de = Done eating
ft = Fifteen minutes after finished eating

q = question
Appendix G. ANOVA plots for each question at each test time for anorexics in treatment less than 2 months, bulimics in treatment less than 2 months, anorexics in treatment more than 2 months, bulimics in treatment more than 2 months, and controls
Figure G.1 Before eating, question 1

Figure G.2 Halfway through eating, question 1

Figure G.3 Done eating, question 1

Figure G.4 Fifteen minutes after finished eating, question 1
Figure G.5 Before eating, question 2

Figure G.6 Halfway through eating, question 2

Figure G.7 Done eating, question 2

Figure G.8 Fifteen minutes after finished, question 2
Figure G.9 Before eating, question 3

Figure G.10 Halfway through eating, question 3

Figure G.11 Done eating, question 3

Figure G.12 Fifteen minutes after finished, question 3
Figure G.13 Before eating, question 4

Figure G.14 Halfway through eating, question 4

Figure G.15 Done eating, question 4

Figure G.16 Fifteen minutes after finished, question 4
Appendix H. Descriptive Statistics for anorexics in treatment less than 2 months, bulimics in treatment less than 2 months, anorexics in treatment for more than 2 months, bulimics in treatment for more than 2 months, and controls
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