Caloric Intake Following Traumatic Brain Injury; The Influence of Food Consistency

By

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Abstract

Traumatic Brain injury (TBI) is a major cause of disability in the United States. TBI patients are often in the hospital for extended periods of time following their injury, and in this time, it is estimated that they lose a significant amount of their lean body mass. This dramatic weight loss places TBI patients in a malnourished state that increases length of hospital stay, increases the likelihood of complications, and prolongs the duration of rehabilitation. It is well known that the nutrient needs of TBI patients are great, however, documentation of their nutrient intake is lacking.

A landmark of great importance in the rehabilitation of the brain-injured patient is the initiation of oral intake. The effects that dysphagia and impairment of cognitive-communicative function have on oral intake have been well documented. However, literature linking psychomotor ability to oral intake in the TBI population is limited. In this randomized clinical trial, 6 TBI patients were given the standard hospital diet and a calorie-dense, high protein finger food diet once they were cleared to initiate oral feeding. Daily food records were collected, and the diets were analyzed. We hypothesized that while on the finger food diet subjects would have a higher calorie and protein intake than when on the standard diet. If available, serum albumin, prealbumin, C-reactive protein, and the CBC panel were measured and evaluated.

The main finding was that the TBI subjects enrolled in our study ate approximately half of their estimated needs. It was also found that there was no significant difference between calorie and protein intake between the two diet types. However, while on the standard diet, subjects ate less calories and protein at dinnertime.

This study is a pilot in an ongoing protocol, and subjects are still being enrolled. The results from this study will give some insight into optimizing nutrition therapy for those with severe head trauma.

Chapter One: Traumatic Brain Injury; Background and Impact

Definition

Traumatic brain injury (TBI) can be classified as any injury to the head or skull that interferes with the normal function of the brain. The injury can be further classified as primary or secondary. A primary brain injury is "caused by direct contact to the head and brain as an immediate result of the initial insult at the moment of injury. The primary cerebral injury may be focal (contusion or laceration), or diffuse (concussion or diffuse axonal injury)" [1]. A secondary injury is caused by a cascade of physiological processes that begin at the time of primary injury, but does not present until later in the clinical course [1,2,3]. Examples of secondary injury include cerebral ischemia, arterial hypotension, hypoxia, infection, and seizures.

Prevalence and Causes

Traumatic brain injury (TBI) results in approximately 350,000 deaths and disabilities in the United States each year. The cost of medical care for TBI patients, including indirect costs associated with the injury (such as loss of productivity) was estimated to be $60 billion in the year 2000 [2,4]. The most common causes of TBI include falls, motor vehicle accidents, struck by/against events (such as striking a stationary object), and assault. Severity of TBI ranges from mild (a concussion), to severe (prolonged coma) [4]. Of those that have suffered a severe TBI, approximately 5.3 million (roughly 2% of the general US population) require assistance to carry out the activities of daily living. Assistance is needed until the patient has had sufficient rehabilitation, and for some, it is needed indefinitely.

Pathophysiology of TBI

When evaluating primary brain injury, the most lethal are focal (extracranial) injuries. The significant forces causing the injury often result in skull fractures that can have devastating effects on the brain tissue [3]. Severity of the fracture depends on the region in which it occurred, nature and thickness of the bone, and presence of sutures.

Another form of primary injury is intracranial injury. These are the result of a sudden blow to the head or a rapid acceleration/deceleration incident. These events can result in intraparenchymal bleeding, subdural hematomas and/or diffuse axonal injury (DAI) [3]. Diffuse axonal injury occurs when the body (and brain) are moving at the same speed, but are suddenly stopped. The brain tissue has a variability of density (gray vs. white matter). This, therefore, results in a different rate of slowing upon sudden impact. Consequently, stretching of the neural axonal connections may occur in these portions of the brain. [5]. Recovery from DAI is variable, and often times the damage is irreversible [2, 3]. Severe DAI can result in a long, deep coma, increased intracranial pressure, persistent brain stem reflex posturing, hypertension, and/or loss of temperature regulation [3]. Primary injury, either focal or diffuse will alter the homeostasis of the brain. Because of this, one of the main goals of treatment following primary injury is preventing a secondary injury, which can cause further damage.

Twenty-five percent of patients who suffer secondary brain injury die as a result of the injury [2]. These secondary injuries which occur minutes to days following the injury include cerebral ischemia, cerebral edema, hypoxia, seizures, increased intracranial

pressure, hypercapnia, and infection [2,3]. Secondary brain injury often results in interruption of the cerebral blood flow and volume, decreased brain perfusion pressure, and altered CNS metabolism. Oxidative damage is another potential complication of head injury. The brain has relatively poor endogenous antioxidant systems, and the problem is compounded with poor perfusion to the brain. In addition the brain has a very poor tolerance for anaerobic metabolism which results in lactic acid production. Oxygen free radicals react with lipid membranes and DNA resulting in neuronal death [2, 3, 6]. The cells in the brain do not readily replicate, therefore the damage done by free radicals is permanent [2, 6].

Chapter Two: Metabolic and Nutritional Implications of Brain Injury

Alterations of Metabolism in TBI

Once a traumatic brain injury has occurred, the body quickly attempts to regain and maintain homeostasis, fight infection, and promote wound healing. The initial phase that occurs after the head injury is the inflammatory response which stimulates a hypermetabolic state. The increased energy expenditure leads to accelerated catabolism of the skeletal muscle. The state of hypermetabolism in the TBI patient lasts anywhere from one week to one year after the injury has taken place, depending on the location and timing of injury [7].

The Metabolic Response to Stress

Immediately following traumatic injury, the inflammatory response begins. The initial phase, called the ebb phase, is characterized by lower calorie expenditure and lasts

approximately 12-24 hours. This is caused primarily by hypovolemia [8]. The next phase, the flow phase, follows and is characterized by increased calorie expenditure and fever. There are several factors that influence the body's metabolism during the initial phases, including release of counter-regulatory hormones, fever, and synthesis and release of acute phase proteins [8, 9].

Counter-regulatory hormones, including catecholamines (such as epinephrine and norepinephrine), glucagon, and glucocorticoids are elevated during periods of stress and trauma and cause a cascade of events, characterized by increased protein mobilization from labile sources, increased lipolysis, and hyperglycemia (table 1). Glucagon stimulates gluconeogenesis, cortisol increases protein catabolism, and catecholmines are primarily responsible for insulin resistance [9]. These hormones are powerful messengers, as are the acute phase proteins.

The counter-regulatory hormones initiate the acute phase response, and there is a shift in the balance of visceral and acute phase proteins, the latter of which increase during times of physiological stress [10]. These shifting proteins include C-reactive protein, ferritin, and components of the inflammatory process, such as cytokines. Cytokines are secreted by mononuclear cells and act as hormone regulators of the immune system (9). Interluekin-1 (IL-1), Interluekin-6 (IL-6), and tumor necrosis factor (TNF) are the primary cytokines that induce the metabolic response to stress, and are major contributors to the increased resting metabolic rate (RMR) [7, 11, 12]. These, in particular are elevated during the stress response (9). They are powerful chemical messengers and act in concert with one another to alter substrate utilization. However, their presence does not fully explain the increased metabolic rate (9).

Table 1. Effects of chemical messengers during the inflammatory response

Chemical Messenger	Function	Result
Cortisol	Increases muscle catabolism	Increased rate of muscle catabolism
Glucagon	Stimulates gluconeogenesis	Increased rate of muscle catabolism
Catecholamines (epinephrine, norepinephrine)	Causes insulin resistance	Hypercatabolism
Cytokines (IL-1, IL-6, TNF)	-Activates immune response - Increases RMR	Increased rate of skeletal muscle catabolism

Cytokines are also an important component of the immune system. They act as messengers between cells involved in immune function, in addition to modifying metabolism. Production of these proteins is essential to creating a hostile environment for pathogens which may have access to the organism as a result of the injury [11]. Hepatic protein synthesis is reprioritized and visceral proteins, such as albumin, prealbumin, and transferrin have limited synthetic rates [10, 12]. Production of these proteins are slowed in order to increase the synthesis of the positive acute phase proteins, whose main purpose is to promote wound healing and combat infection. In addition to redirecting visceral protein synthesis towards synthesis of positive acute phase proteins, the body must also mobilize its own skeletal muscle for this purpose [7, 11]. This causes the body to be hypercatabolic, as well as hypermetabolic. Production of proteins that function in the immune system is a major cause of hypercatabolism in the TBI patient; however, there are other causes, as well.

Within the first 2-6 hours following significant TBI, glycogen stores are depleted [7, 9, 12]. Following traumatic injury, priorities of the body are to supply adequate energy to the brain, fight infection, and promote wound healing. Each of the systems

involved with these processes has a preference for glucose. Skeletal muscle is broken down in order to accommodate the glucose needs of the injured patient as it provides the carbon skeletons needed to make glucose via gluconeogenesis. In a non-stressed individual, the brain would adapt by using ketone bodies (derived from fat stores) as fuel in order to preserve lean body mass. However, in the case of brain injury, as well as other major trauma, this transition to metabolizing alternate fuels is significantly reduced [7]. It is important to note that glucose administration does not halt gluconeogenesis (and therefore skeletal muscle catabolism) in trauma patients, and excessive amounts of exogenous glucose can further exacerbate hyperglycemia, which can cause hepatic steatosis [9]. Hepatic steatosis, otherwise known as "fatty liver", is a condition that is caused primarily by over-feeding [9]. The excess substrate stimulates lipogenesis, which results in the accumulation of fat in the liver [9]. The condition can be partially reversed by feeding an appropriate amount of calories. However, if calories continue to be in excess of energy needs, complications can occur [9]. Complications include intrahepatic cholestasis, hepatocyte dysfunction, and decreased immune competence (from Kupffer cell dysfunction) [9].

In addition to using muscle protein stores for fuel, the brain-injured patient also oxidizes fatty acids at an increased rate [9]. Fatty acids are the preferred energy source for cardiac and skeletal muscle, the liver, and other tissues. In the stress response, both serum linoleic and arachidonic acids decrease while oleic acid increases. This occurs due to the influence of epinephrine, and the rate of free fatty acid release that exceeds the body's ability to oxidize the substrate [9]. The result is increased hepatic triglyceride stores and essential fatty acid depletion. Another factor that contributes to fatty acid

depletion is the hyperglycemia that occurs, as the hyperinsulinemia that results prevents mobilization of adipose tissue [9]. It has been shown that administration of a moderate amount of exogenous lipid can aid in preserving levels of fatty acids [7].

Hypermetabolism and Hypercatabolism

The TBI patient loses up to 1,000 grams of muscle tissue per day, as opposed to non-stressed starved individuals that lose approximately 200-300 grams per day [7]. Because the nitrogen loss is double to three times that of a fasting (non-stressed) human, the muscle breakdown is substantial. Inadequate caloric intake will lead to a 10% loss of skeletal muscle within one week, and feeding inadequate calories for 2-3 weeks could lead to a 30% loss of lean mass, which results in increased risk of mortality [13].

The energy needs of the metabolically stressed patient are approximately twice that of non-stressed individuals, and long term failure to feed adequate calories puts the patient at great risk for protein-calorie malnutrition [7, 13]. The hypermetabolic state of the TBI patient can last anywhere from one week to one year after the injury [7]. In addition to preserving muscle mass, early feeding of the traumatically injured patient has been shown to reduce the rate of infection and reduce the amount of time spent in the intensive care unit (ICU) [7, 12]. Preventing loss of muscle in the early stages of recovery also influences rehabilitation. Malnourished TBI patients (those with a BMI <15) have been shown to be in the rehabilitation unit 28 days longer than those who are not malnourished [20].

Just as feeding too few calories has detrimental effects on the patient, feeding the patient in excess of needs can be just as detrimental as underfeeding, if not more so, for the metabolically stressed patient. Excess calories can lead to hyperglycemia, azotemia,

and hepatic steatosis, as well as more difficulty in weaning patients off of the ventilator [12].

Chapter Three: Feeding the TBI patient

The feeding of the brain-injured patient is affected by many factors, including severity and type of injury, as well as rate of recovery. However, patients typically follow a similar progression when it comes to nutrient delivery. When patients are hemodynamically stable, the first form of nutrition support is usually enteral feeding (EN) or total parenteral nutrition (TPN). Once the patient is clinically expected to be able to tolerate oral intake, a speech and swallowing analysis is done. If the TBI patient is successful in swallowing without aspiration, an oral diet is initiated with consistency advanced as tolerated to a regular texture.

Once TBI patients are hemodynamically stable and able to receive nutrition early in the course of the injury, they are typically intubated and sedated, and enteral feeding and TPN are the only options. The many benefits of early feeding in trauma patients have been well documented [7, 9, 10, 12, 13, 14, 24]. Early feeding has been shown to decrease the rate of infection and the patient's length of stay in the ICU, as well as slow down the catabolism of skeletal muscle. Often the TBI patient is on nutrition support even after waking from coma due to swallowing difficulty. Once the patient has been evaluated by speech pathology and approved to begin oral intake, the patient is typically put on a clear liquid diet, and shortly thereafter, if tolerated, the patient is advanced to a full liquid diet. Although the patient is on a liquid diet for a short period of time, the calorie and protein content of these diets are often inadequate [22, 23]. The next step is

often a texture-modified diet, such as mechanical soft. This is due to the fact that many TBI patients experience dysphagia [15]. Once the swallowing reflex resumes in the patient, the diet is advanced to regular textures. In the progression from nutrition support to approval of a regular textured diet, the segment with the longest duration is the time the patient spends on EN or TPN.

Dysphagia

"Safe and adequate nutrition, vital to the recovery from a traumatic brain injury, can be severely compromised by the presence of dysphagia" [19]. Swallowing disorders are common in the event of a brain injury. It is estimated that the incidence of dysphagia in TBI patients is as high as 61% [15]. Not only is the swallowing reflex commonly impaired in the case of brain injury, other risk factors such as tracheostomies and prolonged ventilation are also common in this population [15]. Although swallowing seems a simple act, it is actually quite complicated involving the coordination of 15 paired muscles, 6 cranial nerves, and several levels of the central nervous system [15]. TBI patients often have deficits in their muscle tone, reflexes, cognition, and sensory functions [15].

One of the most overlooked components of swallowing is the effect of cognition. Cognition appears to be highly correlated with recovery of oral intake in TBI patients [17]. Often with the recovery of cognitive abilities, swallowing function is restored as well [16]. One must have behavioral and cognitive functions intact before oral feeding can be successful [17]. Cognitive issues that may affect the management of dysphagia in TBI patients include deficits in memory, attention span, sensory reception, organization,

and problem solving/judgment [17]. Behavioral issues that may also have an influence include agitation, impulsivity, disinhibition, and apathy [17]. Although the recovery of swallowing is dependent on the recovery of cognitive and behavioral skills, the cognitive outcome of TBI patients is associated with the initiation of oral intake.

Chapter Four: Rationale for the Finger Food Study and its Parameters

It has been shown that the cognitive outcome of brain-injured patients is strongly associated with initiation of oral intake [16, 17]. When compared to age, duration of coma, education, and time of first verbal communication following the injury, the recovery of oral feeding was shown to be the strongest predictor of neuropsychological outcome [16, 18]. The association between oral intake and cognition has been documented; however, literature addressing the effects of psychomotor impairment on oral intake in TBI patients is limited. The process of eating involves hand-eye coordination, supination of wrists, ability to lift food from plate to mouth, releasing food into the mouth, and the grip strength to hold utensils. Just as with cognitive abilities, motor skills are lacking during the recovery phase of TBI. Due to their limitations, we hypothesized that a finger food diet will result in the consumption of adequate calories and protein.

As discussed earlier, TBI patients often experience prolonged periods of hypermetabolism and are in a state of significant nutrient deficit. Strategies to alleviate the decline of nutritional status in the early phases of the clinical course have been well documented [7, 9, 10, 12, 13, 14, 24]. Based on current literature, early enteral feeding is highly encouraged. However, once the patient is weaned off of enteral feeding, it is often

difficult for the patient to orally consume adequate calories to encourage healing. With the physical and cognitive dysfunction common in brain-injured patients, it is suspected that oral intake is insufficient in caloric and protein content, though currently there is a lack of literature that addresses this issue. Inability to feed oneself using eating utensils is thought to be one barrier that TBI patients face when resuming oral nutrition. In this study, we tested the hypothesis that TBI patients were better able to successfully consume nutrients with a finger food diet as opposed to a regular diet using eating utensils. More importantly, we documented the oral intake of this patient population. Although it appears to be well known that these patients have greater caloric expenditure and protein needs, current evidence is lacking as to whether they are able to meet these needs when they initiate oral intake. With the data collected in our study, we will report the oral intake of TBI patients and evaluate their ability to meet their nutrient needs.

During the finger food diet study, calorie counts, macronutrient intake (including grams of protein, carbohydrate, and fat), and lab values, such as C-reactive protein (CRP), albumin, prealbumin, and the standard complete blood count (CBC panel) were analyzed. The primary outcome was quantified by using data gathered from recording intake of foods in a hospital setting. In this setting, calorie counts consist of a crude estimate of the amount a patient has consumed of each food item. It is not an exact calculation of the calories consumed, and it may not include items that have been eaten that were not included on meal trays. Despite its weaknesses, however, it is the best estimate of a patient's intake in a hospital setting, though it may not reflect absolute intake. In this study, it was hypothesized that patients will consume more calories and grams of protein while on the finger food diet. In addition, it was hypothesized that due

to improved nutrient intake during the finger food phase of the diet study, lab values (excluding albumin as it has a longer half life) would improve during this time.

In this study, analysis of lab data will give a general picture of the subject's condition during the study duration. Due to the short time frame of the study, significant shifts in lab values were not expected. Despite this, however, they may give us some insight into the subject's stage of recovery. During the acute phase response, lab values are skewed, and do not necessarily reflect the patient's nutritional status (2, 7, 9, 10, 21). Because of this, it is difficult to define a nutrition marker that can be used to effectively assess a patient's status (10, 21, 25). However, the lab values, interpreted together as well as with other parameters, such as oral intake, ventilator usage, and progress in improving physical activity, are a useful tool to help practitioners determine the care that is needed by the patient (10, 21, 25). For instance, if a patient has low albumin and prealbumin, has poor oral intake and is unable to actively engage in physical therapy appointments, perhaps a nutritional supplement drink is needed in order to improve calorie and protein intake. In this study, in order to get a description of the biochemical markers of the study population, the following lab results were analyzed:

C - reactive protein

CRP is an acute phase protein that rises in times of stress, and is a marker of inflammation. One of the most useful properties of CRP is its short half-life of 19 hours which allows a rapid change with varying conditions (21). It is important to note that CRP is a marker of not just acute inflammation, but chronic inflammation, as well. It is estimated that CRP is slightly raised in approximately one third of the US population in response to dietary, cardiovascular, and other factors (21). The reference range for this

lab parameter is 0.0 – 0.8 mg/dL. In the current study, it was expected that CRP would be slightly elevated, but with a downward trend overall.

Albumin

Albumin is commonly viewed as a marker of long-term nutrition status, mostly due to its long half-life (14-20 days). Albumin is a visceral protein, and it is decreased in times of physiological stress (7, 9, 10, 21). The body re-directs the synthesis of visceral proteins towards synthesis of acute phase proteins and production of carbon skeletons for gluconeogenesis. It is important not to use albumin as the sole marker of nutritional status, as it is affected by various other physiological factors, including hydration status and the systemic action of cytokines and other acute phase proteins (10, 21). In addition, it has been shown that even those who are severely malnourished, such as patients with anorexia nervosa, may have normal albumin levels (21). The reference range for albumin is 3.5 - 4.7 g/dL. In the current study, it was expected that albumin levels would be lower than normal with a gradual upward trend as inflammation is resolved. The effectiveness of nutrition therapy is a factor in whether the albumin level increases as inflammation subsides.

Prealbumin

The properties of prealbumin are similar to those of albumin. The most notable difference, however, is the shorter half-life of prealbumin (2-3 days). Often prealbumin is used as a short-term nutritional marker, however, like albumin, it is affected by multiple other factors besides the diet (21, 25). Prealbumin is decreased during the acute phase response, however with recovery, its levels normalize (assuming the diet is adequate). The reference range for prealbumin is 170 – 420 mg/L. In the current study,

similar to albumin, we expect prealbumin levels to be slightly decreased with a trend upwards.

CBC Panel

The complete blood count (CBC panel) is a measure of the different components of blood, including hemoglobin, hematocrit, red blood cells (RBC), and white blood cells (WBC), among others. In the current study, the primary reason for the use of this panel is to ensure that the patient does not have an infectious process. The concentration of WBC increases during physiologic stress in order to combat infection, and if an infection does indeed occur, the WBC remains elevated. Not all physiologically stressed patients contract infections, though it is not uncommon for this patient population. The reference for WBC is 4.4 – 11.0 10^9/uL. It was expected that subjects in the study would have normal to slightly elevated white blood cell counts that trend downwards.

Taken individually, lab results will tell a practitioner little about the condition of the patient. When viewed together, lab values will provide some insight into the patient's status and will help determine the care that is needed. Nutrition status is difficult to determine from lab values alone, as traditional markers, such as albumin and prealbumin can be influenced by other causes other than diet [10, 21, 25]. Although analysis of these labs are an important indicator that the patient's status is improving, it is also necessary to consider other information, such as anthropometric data, ventilator usage, and progress in physical therapy and occupational therapy sessions, among other factors [21, 25]. In the current study, analysis of the lab results gave a general picture of the condition of the subject at the time of the study diet. Due to the short duration of the study, it was not

expected that lab values would be altered greatly; however, they will give some insight into the subject's stage of recovery.

Chapter Five: Study Design and methods

In this randomized clinical trial, we recruited 2 groups from those hospitalized for Traumatic Brain Injury (TBI). Each patient received the standard diet (Diet A) and also a diet consisting of finger foods (Diet B) in randomized order (menus can be located in Appendix B on page 39). This diet was developed by study investigators in conjunction with OHSU Food and Nutrition Services. The standard diet is normally given to patients who are on non-select diet (they do not select their own foods for mealtimes). The finger food diet was developed to match the amount of macronutrients in the standard diet. All calculations were done using Microsoft Excel [27]. Nutritional analysis was done using product information provided by the manufacturers. The nutrients analyzed were the amounts of macronutrients (in grams), including carbohydrates, protein, and fat. Calories and meal type (breakfast, lunch, dinner, and other time of day) were also analyzed. Diet A and Diet B were isocaloric (+/- 10% kcals) and isonitrogenous (+/- 10% grams of protein). The study took place at Oregon Health and Science University (OHSU), and patients were recruited for the study in the intensive care unit (ICU), as well as other units where TBI patients are transferred after the ICU. Study investigators were informed of possible subjects via staff dietitians, nursing staff, and the speech pathology department. In order to be eligible for the study, participants were required to meet the inclusion/exclusion criteria contained in table 2.

Table 2. Inclusion Criteria for Finger Food Study

- Between the ages of 18-65
- No injuries that would prevent consumption of foods or liquids with regular consistency and texture
- No history of dysphagia prior to brain injury
- No history of prior brain damage, neurological disorders, or psychiatric disorders prior to injury
- Expected to consume a minimum of 12 meals consecutively
- Ate voluntarily and via the oral route prior to injury
- Scored VIII on the Rancho Los Amigos cognitive test
- Does not have an allergy to foods known to be in the protocol
- The patient is able to self - feed

A score of VIII on the Rancho Los Amigos cognitive test is indicative of the patient's ability to make sound decisions independently. Cognitive testing is the standard of care for head traumas, and all patients received these tests. Patients were recruited for the study post-surgery, and the subjects were each assigned a number that was used to identify them throughout the study. Subjects were randomized either to six meals of the finger food diet followed by six meals on the utensil (standard) diet, or six meals of the utensil diet followed by six meals of the finger food diet. Randomization envelopes were paired so that each block contained one that started with the finger food diet and one that started with the standard diet. Study investigators were responsible for randomization.

Patients initiated oral intake when speech pathology had evaluated that it was safe for them to do so. Once patients were cleared, their oral intake was followed for 12 meals, or as long as they were hospitalized if that time was shorter. If a calorie count was missing for any particular meal, an additional meal was ordered in an attempt to collect data for twelve meals (six for each diet type). After enrollment (the consent form is located in Appendix A on page 33), a brief medical history was recorded for each

subject. This medical history included age, race, gender, height, weight, whether the subject is diabetic, and mechanism of injury. A daily record of food eaten by the patient was completed by the nursing staff using standard nursing procedures. Food intake data was collected by study investigators and entered into a password secure database. The food records included the percentage of each of the meal items that the patient consumed. The grams of carbohydrate, protein, and fat were estimated from the food intake data. The percentage of the meal eaten by the patient was determined by a calculation of the approximate calories eaten by the patient versus the approximate number of calories the patient was served according to the menu. Each meal was put into the appropriate quartile based on the percentage of the meal eaten. The quartiles for percentage of calories eaten were 1-25%, 26-50%, 51-75%, and 76-100%. A full meal was considered to be consumption of 75% or greater of the meal. In addition to calorie counts, specific lab values, including albumin, pre-albumin, the standard CBC panel, and C-reactive protein were collected at the same time, if the data was available. It is standard procedure to collect these lab values for all patients with severe head trauma. These lab values were collected from the subject's clinical medical record up to three days after the last study meal. All data was collected on site by study investigators, and information was stored in a locked cabinet located in the primary investigator's office. Patients were followed until discharge from OHSU hospital or the end of the study, whichever occurred first.

Statistical Analysis

The primary outcome for this study was to determine if diet type would increase the likelihood of patients eating 75% of their meal or greater. The secondary outcomes were

defined if there was a relationship between type of diet and an increase and/or decrease in lab values. In addition, we calculated data that described the oral intake of this patient population, and compared it to the estimated nutrient needs. Statistical analysis included ANOVAs, and T-tests for comparison of means, while logistic regressions were attempted in order to calculate odds ratios associated with diet, including increased likelihood of meal consumption by diet. We expected 50% of those on the finger food diet to consume three-quarters of their meal or greater while those on the regular diet would only consume three-quarters of their meal 25% of the time. Without considering confounders, this required a total of sixty-six meals per arm in order to achieve an alpha level of .05 and a power of .8. Due to the nature of this study having a high number of confounders, the number of meals per arm was adjusted to 138 (24 subjects total, 12 subjects per arm). We hoped to consent 60 subjects to account for possible screen failures. Rather than counting individuals enrolled in the study, the analysis was focused on the number of meals. Not all subjects finished all twelve meals, therefore, not all study meals were matched with standard meals. All statistics were done using SPSS, version 15, Chicago, IL [26]. A p-value of 0.05 was considered statistically significant.

Chapter Six: Results

A total of five patients completed the 12-meal study. One patient was discharged prior to completing the entire study, and due to incomplete food intake data, only one meal was counted for this participant. All subjects were male and had suffered a diffuse axonal injury. On average, oral intake was initiated 8.5 days after admission. Five subjects had been on enteral feeds, one subject had been on TPN, and one subject had not

had either EN or TPN. One patient was diabetic. Descriptive statistics can be found in table 3.

Table 3. Descriptive statistics of study population

Patient #	# Meals	Age	Type of Injury	BMI	Diabetes?	Nutrition Support
1	12	29	DAI	Not available	No	EN
2	1	46	DAI	34	No	TPN, EN
3	12	33	DAI	27	No	No
4	12	31	DAI	33	No	EN
5	12	40	DAI	19	No	EN
6	12	68	DAI	28	Yes	EN

There were a total of 61 meals completed for this analysis. Three of the meals were considered snacks, and were not included in the analysis (though, they were included in the daily caloric intake), and the number of meals analyzed was 59. This number includes 32 standard meals, and 27 finger food meals. The intake data for the study population can be found in table 4.

Table 4. Intake data for TBI study population

	Minimum	Maximum	Mean	Std. Deviation
Avg kcal/day	290	1635	1278.8	226.48
Avg. kcal/meal	290	590	454.64	133.65
Avg. grams Protein/meal	0	55	20.25	12.35
Avg. grams Carbohydrate /meal	2	128	50.97	26.18
Avg. grams Fat/meal	0	42	16.79	10.96

On average, subjects consumed approximately 1279 calories (kcals) per day and 454.6 kcals per meal. The amount consumed per meal includes approximately 20 grams of protein, 51 grams of carbohydrate, and 17 grams of fat. Meal type (breakfast, lunch, and dinner), as well as diet type (standard vs. study diet) were evenly distributed (chi-square statistic p-value = .607 and .797, respectively).

In this study, eating a full meal was defined as eating 75% of the meal or greater. This occurred only 20.3% of the time. Subjects ate 26 – 50% of their meals 39% of the time, and 51 - 75% of their meals 25.4% of the time. Subjects consumed 0 – 25% of their meals only 15.3% of the time.

Pearson's correlation coefficients were analyzed in order to check for multi-colinearity. One interesting finding was that those subjects with lower BMIs consumed more calories per meal. With an n of 25 meals (only those subjects with all variables, including lab data were included), BMI was negatively correlated with kcals consumed

per meal (Pearson's correlation = -0.41, p=.042). We also found that older subjects consumed a greater amount of kcals per meal (Pearson's correlation = 0.389, p = 0.002).

There was one strong correlation with the lab parameters. CRP was strongly correlated with average kcals consumed per day (Pearson's = 1.0, p=<0.01). Albumin was not correlated with grams of either protein or fat per meal.

Due to the small sample size, analysis on lab parameters is not possible. Averages are displayed on Table 5. There were a total of 24 meals with lab values present that represented a total of six subjects. Because of this limitation, statistical analysis between lab values and other variables was impossible.

Table 5. Average lab parameters and reference ranges

Lab parameter	Min	Max	Study Average	Reference Range
Albumin (g/dL)	2.6	2.9	2.7	3.5 – 4.7
Prealbumin (g/L)	46	318	176.8	170 – 420
CRP (mg/dL)	4.1	126.0	47.5	0 - 0.8

Standard Diet vs. Study Diet

On the standard diet, subjects consumed approximately 1294 kcals per day and 456 kcals per meal. These meals consisted of, on average, 21 grams of protein, 49 grams of carbohydrate, and 17 grams of fat. While on the finger food diet, the subjects consumed 1261 kcals per day and on average, 453 kcals per meal. The average macronutrient content of the consumed meals was 19 grams of protein, 54 grams of carbohydrate, and 16 grams of fat.

Pearson's correlation coefficients were analyzed for each diet type with each continuous variable in order to see if there were any confounding issues. There was a positive correlation with intake of fat and kcals per meal with the study diet, and not the standard diet ($p=<0.001$).

Next, frequencies were analyzed using chi-squares. Consumption of the meals (breakfast, lunch, and dinner) were evenly distributed (chi-square statistic p-value = 0.797). The percentage of the meal eaten did not differ among the two different diet types ($p = 0.706$). The difference in the calories consumed between the diet types was not significant ($p=0.881$). Diet type did not influence whether subjects ate a full meal, and neither did the meal type. Chi square statistics were not altered by the effect of diet type (standard vs. study diet).

Independent t-tests were performed in order to test any associations between diet type and any of the continuous variables (Appendix C Table 2, page 56). There were no significant differences between the results of the standard diet and the study diet.

A one-way analysis of variance (ANOVA) using a Tukey post hoc test between meal type and the macronutrient intake per meal (Appendix C Table 5, page 59), showed that when fed the standard diet, there was no statistically significant difference between the kcals eaten at lunch and breakfast, however, there was a trend for reduced consumption at dinner. There was a significantly reduced intake of calories, protein, and fat ($p=0.002$, 0.013, and <0.001, respectively) at dinnertime. During the regular diet phase, subjects consumed approximately 289 kcals less at dinner than they did at lunch ($p=0.003$) and 242 kcals less than they did at breakfast ($p = 0.015$). In addition, dinner on the regular diet is associated with decreased protein intake as compared to other meals.

Subjects consumed approximately 15.9 g less protein compared to breakfast, and 11.2 grams less protein than they did at lunch (p=0.012 and 0.094 respectively).

While on the finger food diet, subjects ate approximately the same number of kcals for each meal (Appendix C table 6, page 60). Thus, subjects consumed more kcals during the dinner meal while on the study diet than they did on the standard diet. As with the standard diet, less protein was consumed at the dinner meal as compared to breakfast and lunch (p=0.025). Subjects consumed approximately 10.2 grams of protein less than they did at breakfast and 13.7 grams less than they did at lunch (p=0.025 and 0.092, respectively).

ANOVA was used to analyze the effect that the percentage of the meal eaten had on continuous variables. It was shown that there was a significant association between the third quartile range (50-74% of meal eaten) and prealbumin and albumin. In other words, eating 50% of the meal or greater was associated with higher prealbumin and albumin levels. Independent t-tests showed that consumption of full meals (75% or greater of the meal) did not have a statistically significant impact on lab results. The results were consistent for each diet type.

Logistic regression showed that without any adjustments, the odds of eating 75% or greater of a meal on the study diet increased by 1.89, however, this finding was not statistically significant (p=0.332). When meal type was added into the model, the ORs remained the same.

In summary, results show that the diet type (either finger foods or control diet), did not have any significant effects on how much a subject consumed. However, it was shown that while on the finger food diet, subjects ate a consistent amount of calories

throughout the day, as opposed to the standard diet where subjects ate less at dinner time. In addition, it was shown that on the standard diet, those with higher BMIs ate less, however, the study diet eliminated the relationship between BMI and the amount eaten. Finally, it was shown that the critical amount that a subject must eat in order to influence albumin and prealbumin is 50% of the meal or greater.

Chapter Seven: Discussion

In this pilot study, our primary aim was to see if subjects consumed more calories and grams of protein on the finger food diet as compared to the standard diet that the hospital normally serves. According to the analysis, subjects consumed about the same number of calories on either diet, however, they were more likely to consume calories more consistently throughout the day on the finger food diet. While on the standard diet, study participants consumed more calories earlier in the day, and ate significantly less at their dinner meal. This trend was not observed for those on the finger food diet. While on the study diet, there were no differences in the calories consumed among the different meals throughout the day. Subjects consumed approximately the same amount of protein on either diet; however, there were some variations in protein consumption throughout the day. On both diets, subjects ate less protein at dinner than they did at breakfast and lunch. Because of the preference shown for breakfast and lunch, practitioners can attempt to increase intake by adding additional items on breakfast and lunch meal trays.

A comparison of lab parameters for this study was the secondary aim for this study. Because the study protocol was not intended to require additional blood draws, not all subjects had results for the desired lab work. Due to the short duration of the

study, a drastic change in lab parameters was unlikely (especially with albumin, due to its long half life), however, some variations were noted. The average albumin lab results were lower than the reference range, prealbumin was at the lower end of the reference range, and the CRP was much higher than the reference range. These lab results may indicate that inflammation has not completely subsided. Due to inflammation still being present, it is possible that this was a major influence on their lack of appetite. The correlation that CRP had with the average kcals consumed per day was unexpected, as it would seem that this would be a negative correlation (the higher the CRP value, the less the subject would eat). The strong positive correlation may just be due to a premature statistical analysis of this lab value, as not all subjects had results for CRP. It should also be noted that the high CRP level (47.5) indicates that patients are still catabolic and in an inflammatory state, and nutrient needs are increased.

One finding of interest was that eating 50-74% of meals had a stronger effect on prealbumin and albumin than the other three quartiles. In this analysis, 50% or greater was a critical threshold that must be maintained in order to have an impact on lab results. Though not all patients had prealbumin and albumin lab results available, this outcome does indicate that there may be a link between the amount that a patient eats and their visceral protein stores at this stage of the recovery process.

Another interesting finding was that on the standard diet, as BMI increased, the amount of calories consumed decreased. This association was not seen while on the study diet. In other words, the study diet eliminated the BMI factor when it came to calorie intake.

One of the largest drawbacks of this study is the small sample size. The study inclusion criteria were very specific, and limited the population pool from which to recruit. Often by the time TBI patients are approved for diet advancement to regular textures by the speech pathology department, they are discharged from the hospital shortly thereafter. Unless the patient had other injuries keeping them hospitalized, enrollment into the study was not possible due to the short time frame of eligibility. In addition, it was common for enrolled subjects to be discharged from the hospital while still enrolled in the study. It should also be noted that historically the majority of traumatic brain injuries occur in the spring and summer months. This study started recruitment in the fall, and incidence of TBI is dramatically decreased during the fall and winter months. Recruitment is still active for this protocol.

The study was designed to assess nutrient intake for each meal rather than each day or each study participant. Due to reasons stated above, patients are often discharged shortly after oral intake has been initiated, and not all study meals will necessarily be matched with a regular meal. In this type of design, it is assumed that each meal is independent of the other meals. This is not necessarily true due to the influence of the individual. To compensate for this lack of independence, this study would have been required to recruit 244 subjects and each subject would have been required to eat only one meal.

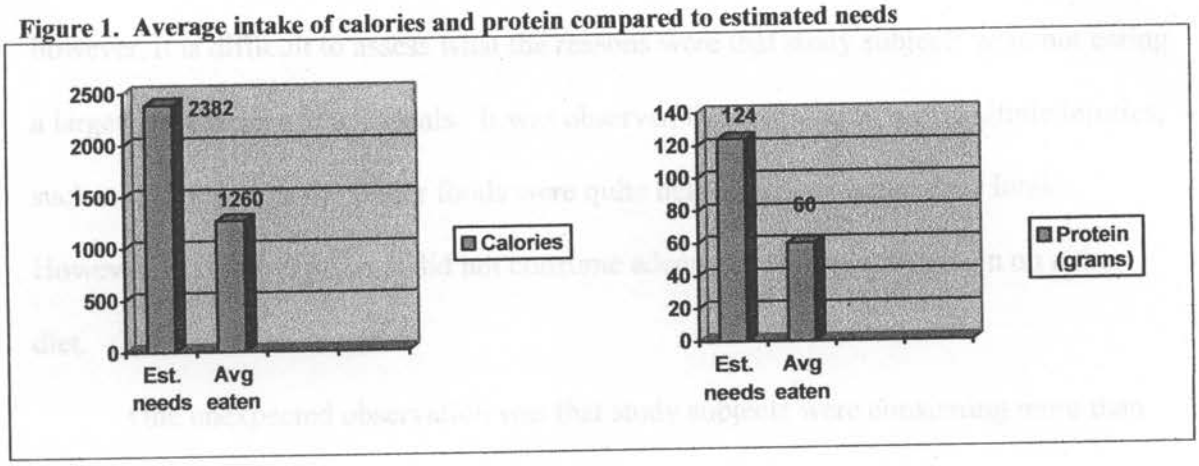
Another weakness of this study design was the use of the standard hospital procedure to obtain food intake data. Food intake records are rough estimates of the percentage of food eaten and were completed by the nursing staff. They may not capture accurate accounts of what the patient was actually eating or drinking. Often visitors

would bring food for study subjects and leave items in their rooms, though it was unclear if patients actually consumed the outside food, as it was rarely recorded on calorie counts. The ideal diet study in a hospital setting would have been similar to diet studies carried out in general clinical research centers. The food would have been weighed and measured before and after consumption in order to get a more accurate calculation of the amount eaten. Even in this ideal situation, controlling for calories consumed from food that is brought into the hospital by visitors would still be difficult to assess.

Despite the weaknesses of this study, it still gives some insight into the diet patterns of those who have suffered a traumatic brain injury. The increased energy expenditure of these patients is well documented. However, no published studies to date have looked at how much these patients are eating. On average, the subjects in this study had a height of 183 cm (71.9 inches) and a weight of 91.6 kg (201.8 pounds). It should be noted that nutritional goals are unique to the individual, however, using general guidelines, we can approximate the average needs. In order for study subjects to maintain their weight or gain lost skeletal muscle, calorie needs are approximately 2289-2475 calories per day (25-27 kcals/kg using 91.56 kg), and 110-137 grams of protein (1.2-1.5 grams of protein using 91.56 kg). These calorie and protein ranges are the averages for the nutrition goals the dietetic staff had set for the study participants. The average caloric intake for study participants was, on average 1278 kcals per day, and did not exceed 1635 kcals for a daily average. Protein intake was approximately 60 grams per day. The nutrient intake for the subjects in this study was deficient in both calories and protein, regardless of the type of diet that they were on. At such a critical time in

the recovery and rehabilitation process, it is important to find ways to increase calorie and protein intake for these patients. As mentioned earlier, malnutrition, especially protein deficits, can lengthen the time spent in rehabilitation, and increases the incidence of complications. For this reason, optimizing medical nutritional therapy at this time would be highly beneficial to these patients.

Figure 1. Average intake of calories and protein compared to estimated needs



Though there were some positive trends seen when the finger food diet was administered, it did not appear to be the answer in improving the oral intake of recipients so that they were meeting their nutritional goals. Prior to enrollment, patients often stated that they were not eating due to lack of appetite. Recovery of appetite often comes with an improvement in the patient's medical status. In the time period from weaning off of tube feeds and initiating oral intake to the time of adequate appetite recovery and oral intake, patients are getting inadequate nutrients. Often dietitians will attempt to keep patients on nocturnal tube feeds until the patient is eating a sufficient amount of calories on their own. In this study, all subjects were off of tube feeds completely. Several study

subjects had been prescribed nocturnal tube feeds, however, due to the confused state following TBI, they often pull the feeding tube out themselves. Without providing additional calories from nocturnal feeds, patients were eating insufficient amounts on their own.

It was hypothesized that due to the nature of brain injury accidents, patient would have difficulty eating. The hand-eye coordination, cognition, and behavioral aptitude needed for feeding oneself may not be fully recovered. This was perhaps the case; however, it is difficult to assess what the reasons were that study subjects were not eating a larger percentage of their meals. It was observed that in patients with multiple injuries, such as broken arms, the finger foods were quite helpful in increasing their intake. However, even these patients did not consume adequate calories and protein on either diet.

One unexpected observation was that study subjects were consuming more than half of their calories from liquids. Due to the preference of liquids, future studies may attempt to answer the question of whether more calories are consumed if supplement drinks are added into the diets of TBI patients. Perhaps future studies will concentrate on increasing the appetite of TBI patients. One other solution could be to keep patients on tube feeds until they can demonstrate sufficient intake. The finding in this study that subjects consumed more calories and protein at lunch and breakfast can also be a factor in meal planning for TBI patients. Perhaps protein-rich foods that the patient enjoys can be added to meal trays for meals earlier in the day in order to optimize daily caloric and protein intake. In the institution at which the study was conducted, patients order meals for the following day. Perhaps if subjects were able to order their own food, their meal

consumption would have been greater. Because of the nature of head injury, it would be difficult to single out a reason as to why intake is insufficient, however, with knowledge that this is occurring, there are numerous ways to help alleviate the problem.

It is unclear why study subjects would eat more calories and protein at breakfast and lunch and eat less at dinner. Though the standard diet and the study diet are evenly matched for each meal when it came to macronutrients and calories, the calories and macronutrients are not consistent throughout the day. For instance, at breakfast patients are served less calories and protein than they are at dinner time. Despite the disparity in the calories and grams of protein, subjects still consumed more of each during breakfast. One thought is that the consistency of the protein source may have contributed to this. For the regular diet, each protein source at dinner time had gravy, and at lunch time, meals included items such as oven fried chicken or spaghetti and meatballs. For the study diet, the consistency of the protein sources contained less moisture. Aside from differences in the foods that were served, it is not clear why patients would consistently consume less nutrients at dinner, especially while on the standard diet.

In this randomized diet study, it was shown that regardless of the diet, study subjects consumed insufficient calories and protein to optimally promote healing and improvement or maintenance of nutrition status. It was predicted that while on the finger food study diet, subjects would consume more calories and protein than when they were on the hospital's standard diet. Though there were some positive trends, the study size was too small to show any effect of either diet. Despite the small size of the study, there was valuable information reported concerning the amount of calories and protein that TBI patients consume. It was shown that their calorie and protein consumption were

insufficient, and the question still remains regarding how to improve their intake. Study subjects appeared to have a preference for liquids, and perhaps might benefit from supplemental drinks. It may also be beneficial to continue tube feeds until patients are eating a sufficient amount of calories orally. The finger food diet did not appear to improve the intake of TBI patients in our study of limited sample size. However, due to the negative effects that malnutrition has on rehabilitation and patient outcomes, it is important that research continue to evaluate ways of improving oral intake in the TBI population.

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Appendix A: Consent Form

OREGON HEALTH & SCIENCE UNIVERSITY
Consent & Authorization Form

TITLE: *Caloric Intake Following Traumatic Brain Injury; the Influence of Food Consistency*

PRINCIPAL INVESTIGATOR: Robert Martindale MD, PhD (503) 494-8372

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Natalia Bailey BS (503) 494-8372

Richard Mullins, MD (503) 494-5300

Martin Schreiber MD (503) 494- 5300

SPONSOR: Oregon Health & Science University Department of Surgery

You have been invited to participate in this study because you've had a traumatic brain injury. This form contains important information about the study in which you are being invited to participate. Please read the form carefully, ask questions of the investigators or others who are obtaining your consent to participate in the study, and take time to think about your participation. You may want to discuss the study with your family or friends before agreeing to be in the study.

What is the purpose of this study?
Traumatic Brain Injury (TBI) is a serious injury that affects millions of people every year. Patients who suffer from TBI lose about 30% of their body weight during the time that they are in the hospital. Their energy needs are very high, and often these patients cannot eat the amount that is needed in order to meet their needs. Many times, they are not able to use utensils (forks, knives, and spoons) well enough to eat their meals. The purpose of this study is to evaluate whether TBI patients on finger food diets will be able to consume more than if they are on a regular diet that requires utensils. Both the finger food diet and the regular diet are standards of care in hospitals. We will be doing this evaluation by reviewing how much food you consume based on diet and if your lab values get better.

What is required to participate in this study?
To qualify for this study, you must meet the following criteria:

1. Be between the ages of 18 to 65.
2. Were on a regular, textured diet prior to your injury. This means that you did not have to grind or puree your foods.
3. You must have no history of swallowing difficulty prior to your traumatic brain injury.
4. You have no history of prior brain damage, neurological disorders, or psychiatric illness prior to your traumatic brain injury.
5. You can be followed for a minimum of 12 meals during your stay at OHSU Hospital
6. You voluntarily ate orally prior to your traumatic brain injury.
7. You have no injuries that would prevent regular consumption of regular consistency and texture foods or liquids.
8. You have scored 8 on the Rancho Los Amigos cognitive test.
9. You do not have an allergy to foods know to be in the protocol.
10. You are able to eat with their extremities.

What can I expect as a study participant?
You will be in the study for a maximum of 12 meals. These meals will either be created under a finger food diet, or a diet where you need to use utensils. You will be randomized into one of two groups. The first group will receive the finger food diet for two days, then the utensil diet for two days. The other group will start with the utensil diet for two days, and then go on the finger food diet for two days. You have an equal chance of being placed in either one of the groups (like flipping a coin). While in this study, you will not be able to pick your menu, but the finger food meal will attempt to duplicate the regular menu. If you feel the meal that you have been provided is inadequate, you will be able to have a meal of the other diet type.

If you are on this study, your lab values will be recorded up to three days after the last study meal. The lab values that will be tracked are for albumin, prealbumin, c-reactive protein, and standard CBC. No additional labs will be taken for this study. Only information for labs done during your standard of care will be recorded.

If you have any questions regarding this study now or in the future, please contact Dr. Robert Martindale (503) 494-8372 , or page him by calling (503) 494-9000 and ask for pager 10720.

What effect will this study have on my care?
You will not be able to select your meals for the 12 meals during this study.

How will my privacy be protected?

We will protect your privacy in the following ways:

1. Your name or other protected information will not be used. Instead, we will identify you by a code number.
2. Only study investigators will be able to access your information.
3. All research charts will be identified by a subject number only and will not contain any personal information.
4. Only the consent form will have both your name and subject number. This will be locked in the principal investigator's (Dr. Robert Martindale) office.

5. The study database will be on a password protected server. Only the principal investigator, sub investigators, and research staff will be able to have access to this information.

The purposes of our use and disclosure of this health information are described in the **Purpose** section of this Consent & Authorization Form.

The persons who are authorized to use and/or disclose your health information are all of the investigators who are listed on page one of this Research Consent Form and the OHSU Institutional Review Board.

The persons who are authorized to receive this information are officials at the Office for Human Research Protections as required for their research oversight and public health reporting in connection with this research study.

This authorization will expire and we will no longer keep protected health information that we collect from you in this study when the study is over.

What are the possible risks of participating in this study?

Although we have made every effort to protect your identity, there is a minimal risk of loss of confidentiality. In addition, though we have attempted to create a diverse and palatable menu, you may receive food you don't like.

What are the possible benefits of participating in the study?

You may or may not personally benefit from being in this study. However, by serving as a subject, you may help us learn how to benefit patients in the future. There is a possibility that on one of the diets, you will be able to eat more, therefore improving/maintaining your nutritional status.

Will it cost anything to participate?

No, there is no additional cost you to participate in the study.

What if I am harmed or injured in this study?

If you believe you have been injured or harmed while participating in this research and require immediate treatment, contact Dr. Robert Martindale via pager. Call the operator at (503) 494-9000 and pager # 10720.

The Oregon Health & Science University is subject to the Oregon Tort Claims Act (ORS 30.260 through 30.300). If you suffer any injury and damage from this research project through the fault of the University, its officers or employees, you have the right to bring legal action against the University to recover the damage done to you subject to the limitations and conditions of the Oregon Tort Claims Act. You have not waived your legal rights by signing this form. For clarification on this subject, or if you have further questions, please call the OHSU Research Integrity Office at (503) 494-7887.

What are my rights as a participant?

If you have any questions regarding your rights as a research subject, you may contact the OHSU Research Integrity Office at (503) 494-7887.

You do not have to join this or any research study. If you do join, and later change your mind, you may quit at any time. If you refuse to join or withdraw early from the study, there will be no penalty or loss of any benefits to which you are otherwise entitled.

You have the right to revoke this authorization and can withdraw your permission for us to use your information for this research by sending a written request to the Principal Investigator listed on page one of this form. If you do send a letter to the Principal Investigator, the use and disclosure of your protected health information will stop as of the date he/she receives your request. However, the Principal Investigator is allowed to use information collected before the date of the letter or collected in good faith before your letter arrives. Revoking this authorization will not affect your health care or your relationship with OHSU.

If the researchers publish the results of this research, they will do so in a way that does not identify you unless you allow this in writing.

Your health care provider may be one of the investigator[s] of this research study, and as an investigator is interested in both your clinical welfare and in the conduct of this study. Before entering this study or at any time during the research, you may ask for a second opinion about your care from another doctor who is in no way involved in this project. You do not have to be in any research study offered by your physician.

You may be removed from the study if the investigator or the sponsor stops the study, or if you lose the ability to eat regular textured food. You will also be removed if you do not follow instructions.

You may withdraw from the study at any time. This will not affect your care at OHSU, and you will be placed on a standard diet regime.

To participate in this study, you must read and sign this consent and authorization form. If you withdraw your authorization for us to use and disclose your information as described above, you will be withdrawn from the study.

If you wish to participate in this study and sign this form, we will give you a copy of this form.

SIGNATURES:

Your signature below indicates that you have read this entire form and that you agree to be in this study.

OREGON HEALTH & SCIENCE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
PHONE NUMBER (503) 494-7887
CONSENT/AUTHORIZATION FORM APPROVAL DATE

Sep. 26, 2006

Do not sign this form after the Expiration date of: 9/25/2007

Signature of subject	***Printed name of subject***	***Date consent signed***
Signature of consenter	***Printed name of consenter***	***Date consented***
Signature of witness	***Printed name of witness***	***Date signed***
Principle investigator signature	***Dr. Robert Martindale Principle investigator (printed)***	***Date signed***

Appendix B: Standard and Finger Food Menus

Regular Diet Sunday

Sunday Breakfast	CHO (g)	PRO (g)	FAT (g)	Kcal
Orange Juice	12	1	0	52
2% Milk	12	8	5	125
Cornflakes	17	1	0	72
French toast w/apple compote	51	14	12	368
Sugar	4	0	0	16
Margarine	0	0	4	36
ND creamer	2	0	1	17
Kobos coffee	0	0	0	0
Total (g)	**98**	**24**	**22**	
Total Kcal	**392**	**96**	**198**	**686**

Sunday Lunch	CHO (g)	PRO (g)	FAT (g)	Kcal
2% Milk	12	8	5	125
Three bean salad	13	2	1	69
oven fried chicken	12	29	14	290
Mashed potatoes w/ gravy	18	3	3	111
Broccoli	5	3	0	32
Lemon Bavarian	30	1	3	151
Wheat bread	12	2	1	65
margarine	0	0	4	36
Total (g)	**102**	**48**	**31**	
Total Kcal	**408**	**192**	**279**	**879**

Sunday Dinner	CHO (g)	PRO (g)	FAT (g)	Kcal
2% Milk	12	8	5	125
Garden salad	2	1	0	12
1000 island dressing	2	0	5	53
Roast beef w/ gravy	0	21	23	291
Mashed pot.w/gravy	18	3	3	111
Sugar Cookies 2	20	2	6	142
Wheat roll	18	3	2	102
Margarine	0	0	4	36
Total (g)	**72**	**38**	**48**	
Total Kcal	**288**	**152**	**432**	**872**
			Total kcal/day	**2437**
	1088	440	909	

Regular Diet Monday

Monday Breakfast	CHO (g)	PRO (g)	FAT (g)	Kcal
Orange Juice	12	1	0	52
2% Milk	12	8	5	125
Oatmeal	18	4	2	106
Scrambled egg	1	10	10	134
banana muffin	36	3	6	210
Margarine	0	0	4	36
Total (g)	**79**	**26**	**27**	
Total Kcal	**316**	**104**	**243**	**663**

Monday Lunch	CHO (g)	PRO (g)	FAT (g)	Kcal
2% Milk	12	8	5	125
Coleslaw	8	1	2	54
Chicken teriyakin w/ rice	32	33	17	413
Wheat bread	12	2	1	65
Margarine	0	0	4	36
Oatmeal Raisin Cookies2	15	1	5	109
Total (g)	**79**	**45**	**34**	
Total Kcal	**316**	**180**	**306**	**802**

Monday Dinner	CHO (g)	PRO (g)	FAT (g)	Kcal
2% Milk	12	8	5	125
Ceaser salad	7	3	3	67
Ceaser dressing	3	2	20	200
Swiss steak	7	3	26	274
Parslied potatoes	29	3	0	128
Green beans	4	1	0	20
Wheat roll	18	3	2	102
Margarine	0	0	4	36
Chocolate pudding	29	2	5	169
Total (g)	**109**	**25**	**65**	
Total Kcal	**436**	**100**	**585**	**1121**
			Total Kcal/day	**2586**
	1068	384	1134	

Regular Diet Tuesday

Tuesday Breakfast	CHO (g)	PRO (g)	FAT (g)	Kcal
Orange Juice	12	1	0	52
2% Milk	12	8	5	125
Rice Krispies	21	2	0	92
Scrambled Egg	1	10	10	134
Cranberry Muffin	37	5	20	348
Kobos coffee	0	0	0	0
Margarine	0	0	4	36
ND creamer	2	0	1	17
Total (g)	**85**	**26**	**40**	
Total Kcal	**340**	**104**	**360**	**804**

Tuesday Lunch	CHO (g)	PRO (g)	FAT (g)	Kcal
2% Milk	12	8	5	125
Pesto pasta salad	11	3	8	128
Oven fried chicken	18	35	17	365
Mashed pot. w/gravy	18	3	3	111
veg. Medley	8	2	0	40
Pudding parfait	20	3	2	110
Wheat bread	12	2	1	65
Margarine	0	0	4	36
Total (g)	**99**	**56**	**40**	
Total Kcal	**396**	**224**	**360**	**980**

Tuesday Dinner	CHO (g)	PRO (g)	FAT (g)	Kcal
2% milk	12	8	5	125
Garden Salad	2	1	0	12
1000 island	2	0	5	53
Roast turkey w/gravy	4	30	6	190
Mashed pot. w/ gravy	18	3	3	111
Broccoli	4	2	0	24
Wheat roll	18	3	2	102
Rice Krispy Square	17	2	1	85
Cranberry sauce	27	0	0	108
Total (g)	**104**	**49**	**22**	
Total Kcal	**416**	**196**	**198**	**810**
			Total kcal/day	**2594**
	1152	524	918	

Regular Diet Wednesday

Wednesday Breakfast	CHO (g)	PRO (g)	FAT (g)	Kcal
Orange Juice	12	1	0	52
2% Milk	12	8	5	125
Oatmeal	18	4	2	106
Blueberry pancakes w/syrup	65	9	11	395
Kobos coffee	0	0	0	0
Margarine	0	0	4	36
ND creamer	2	0	1	17
Total (g)	**109**	**22**	**23**	
Total Kcal	**436**	**88**	**207**	**731**

Wednesday Lunch	CHO (g)	PRO (g)	FAT (g)	Kcal
2% milk	12	8	5	125
Marinated veg. Salad	7	1	2	50
Mac and cheese	21	4	17	253
Peas	13	4	0	68
Choc. Chip cookie	40	3	11	271
Wheat bread	12	2	1	65
Margarine	0	0	4	36
Total (g)	**105**	**22**	**40**	
Total Kcal	**420**	**88**	**360**	**868**

Wednesday Dinner	CHO (g)	PRO (g)	FAT (g)	
2% Milk	12	8	5	
Garden salad	2	1	0	
French dressing	2	0	5	
Meatloaf w/gravy	13	26	21	
Mashed pot. w/gravy	18	3	3	
Veg. Medley	8	2	0	
Applesauce cake	40	3	9	
Wheat roll	18	3	2	
Margarine	0	0	4	
Total (g)	**113**	**46**	**49**	
Total Kcal	**452**	**184**	**441**	**1077**
			total kcal/day	**2676**
	1308	360	1008	

Regular Diet Thursday

Thursday Breakfast	CHO (g)	PRO (g)	FAT (g)	Kcal
Orange Juice	21	1	0	88
2% Milk	12	8	5	125
Cheerios	13	2	1	69
Scrambled egg	1	10	10	134
Blueberry muffin	24	3	1	117
Kobos coffee	0	0	0	0
Margarine	0	0	4	36
ND Creamer	2	0	1	17
Total (g)	**73**	**24**	**22**	
Total Kcal	**292**	**96**	**198**	**586**

Thursday Lunch	CHO (g)	PRO (g)	FAT (g)	Kcal
2% Milk	12	8	5	125
Creamy coleslaw	8	1	2	54
Garden quiche	18	12	18	282
Roasted veg.	11	2	4	88
Double Fudge Brownies	35	1	9	225
Wheat bread	12	2	1	65
Margarine	0	0	4	36
Total (g)	**96**	**26**	**43**	
Total Kcal	**384**	**104**	**387**	**875**

Thursday Dinner	CHO (g)	PRO (g)	FAT (g)	
2% milk	12	8	5	125
Garden Salad	2	1	0	12
French dressing	2	0	5	53
Salisbury steak	3	28	24	340
Mashed pot. w/ gravy	18	3	3	111
Peas	13	4	0	68
Wheat roll	18	3	2	102
Margarine	0	0	4	36
Bread pudding	46	10	11	323
Total	**114**	**57**	**54**	
Total Kcal	**456**	**228**	**486**	**1170**
			total kcal/day	**2631**
	1132	428	1071	

Regular Diet Friday

Friday Breakfast	CHO (g)	PRO (g)	FAT (g)	Kcal
Orange Juice	12	1	0	52
2% Milk	12	8	5	125
Oatmeal	18	4	2	106
Blueberry pancake w/syr.	62	9	12	392
Kobos coffee	0	0	0	0
Margarine	0	0	4	36
ND creamer	2	0	1	17
Total (g)	**106**	**22**	**24**	
Total Kcal	**424**	**88**	**216**	**728**

Friday Lunch	CHO (g)	PRO (g)	FAT (g)	Kcal
2% milk	12	8	5	125
Mixed bean salad	13	2	1	69
Vegetarian lasagne	32	20	10	298
Garlic bread	23	4	6	162
Cherry crisp	23	1	5	141
Gingersnaps 3	10	1	2	62
Total (g)	**113**	**36**	**29**	
Total Kcal	**452**	**144**	**261**	**857**

Friday Dinner	CHO (g)	PRO (g)	FAT (g)	
2% milk	12	8	5	60
Garden salad	2	1	0	125
French dressing	2	0	5	431
Beef and veg. Stew	18	14	8	189
country biscuit	32	10	3	84
Margarine	0	0	4	66
Lemon cake	36	4	5	
Total (g)	**102**	**37**	**30**	
Total Kcal	**408**	**148**	**270**	**826**

			total kcal/day	**2411**
	1284	380	747	

Regular Menu Saturday

Saturday Breakfast	CHO (g)	PRO (g)	FAT (g)	Kcal
Orange Juice	12	1	0	52
2% Milk	12	8	5	125
Oatmeal	18	4	2	106
Scrambled egg	1	10	10	134
Bran raisin muffin	26	3	8	188
Margarine	0	0	4	36
ND Creamer	2	0	1	17
Total (g)	**71**	**26**	**30**	
Total Kcal	**284**	**104**	**270**	**658**

Saturday Lunch	CHO (g)	PRO (g)	FAT (g)	Kcal
2% milk	12	8	5	125
Potato salad	34	3	13	265
spagetti and meatballs	57	23	16	464
Tapioca pudding	15	5	5	125
Wheat bread	12	2	1	65
Margarine	0	0	4	36
Total (g)	**130**	**41**	**44**	
Total Kcal	**520**	**164**	**396**	**1080**

Saturday Dinner	CHO (g)	PRO (g)	FAT (g)	Kcal
2% milk	12	8	5	125
Garden salad	2	1	0	12
Italian dressing	2	0	9	89
Roast pork w/gravy	0	25	11	199
Mashed pot. w/gravy	18	3	3	111
Green beans	4	1	0	20
Chocolate cake	34	3	11	247
Wheat roll	18	3	2	102
Margarine	0	0	4	36
Total (g)	**90**	**44**	**45**	
Total Kcal	**360**	**176**	**405**	**941**

			total kcal/day	**2679**
	1164	444	1071	

Finger food menu Sunday

Sunday Breakfast	CHO (g)	PRO (g)	FAT (g)	Kcal
Orange Juice	12	1	0	52
2% Milk	12	8	5	125
Hardboiled egg	1	6	5	73
Graham crackers	16	2	2	90
bacon 2 slices	0	3	4	48
Power bar	20	10	10	210
1/2 banana	13	1	0	56
Total (g)	**74**	**31**	**26**	
Total Kcal	**296**	**124**	**234**	**654**

Sunday Lunch	CHO (g)	PRO (g)	FAT (g)	Kcal
Cranapple juice	16	0	0	64
2% Milk	12	8	5	125
Chicken Strips 4	15	14	12	224
potato russettes 5	17	3	10	170
1/2 Banana	13	1	0	56
Power bar	20	10	10	210
Total (g)	**93**	**36**	**37**	
Total Kcal	**372**	**144**	**333**	**849**

Sunday Dinner	CHO (g)	PRO (g)	FAT (g)	Kcal
Apple Juice	15	0	0	60
2% Milk	12	8	5	125
Grilled Cheese	26	17	22	370
French Fries 10	17	2	4	112
Relish Plate	5	2	0	28
Ranch Dressing	1	1	6	62
Sugar Cookies 2	20	2	6	142
Total (g)	**96**	**32**	**43**	
Total Kcal	**384**	**128**	**387**	**899**

			Total kcal/day	**2402**
	1052	396	954	

Finger food menu Monday

Monday Breakfast	CHO (g)	PRO (g)	FAT (g)	Kcal
Orange Juice	12	1	0	52
2% Milk	12	8	5	125
1 2 oz sausage patty	0	8	15	167
Scrambled 1 egg	1	10	10	134
English muffin	28	5	1	141
Grapes 1 c	16	0	0	64
Total (g)	**69**	**32**	**31**	
Total Kcal	**276**	**128**	**279**	**683**

Monday Lunch	CHO (g)	PRO (g)	FAT (g)	Kcal
Apple Juice	15	0	0	60
2% Milk	12	8	5	125
PB&J Sandwich	43	10	10	302
Doritos	17	2	7	139
Banana 1/2	13	1	0	56
Oatmeal Raisin Cookies2	15	1	5	109
Total (g)	**115**	**22**	**27**	
Total Kcal	**460**	**88**	**243**	**791**

Monday Dinner	CHO (g)	PRO (g)	FAT (g)	Kcal
Grape Juice	21	1	0	88
2% Milk	12	8	5	125
Fish Sticks	18	15	16	276
French Fries 20	34	4	8	224
Relish plate	5	2	0	28
Ranch	1	1	6	62
Cheese sticks 2 oz	1	14	19	231
Graham crackers (1 pckg)	16	2	2	90
Total (g)	**108**	**47**	**56**	
Total Kcal	**432**	**188**	**504**	**1124**
			total Kcal/day	**2598**
	1168	404	1026	

Finger food menu Tuesday

Tuesday Breakfast	CHO (g)	PRO (g)	FAT (g)	Kcal
Orange Juice	12	1	0	52
2% Milk	12	8	5	125
Hard Boiled Egg	1	6	5	73
Country Biscuit	32	10	3	195
Bacon 2 slices	0	3	4	48
Grapes 1 c	16	0	0	64
Power bar	20	10	10	210
Total (g)	**93**	**38**	**27**	
Total Kcal	**372**	**152**	**243**	**767**

Tuesday Lunch	CHO (g)	PRO (g)	FAT (g)	Kcal
Grape Juice	21	1	0	88
2% Milk	12	8	5	125
Chicken Strips 3	12	10.5	9	171
Relish Plate	5	2	0	28
Ranch Dressing	1	1	6	62
French Fries 10	17	2	4	112
Watermelon 1 c	12	1	0	52
Cookie of the Day	21	2	8	164
Total (g)	**101**	**27.5**	**32**	
Total Kcal	**404**	**110**	**288**	**802**

Tuesday Dinner	CHO (g)	PRO (g)	FAT (g)	Kcal
Apple Juice	15	0	0	60
2% Milk	12	8	5	125
Hamburger	24	32	23	431
Potato russettes	17	3	10	170
String cheese	1	8	1.5	49.5
Sugar cookies (2)	20	2	6	142
Total (g)	**89**	**53**	**45.5**	
Total Kcal	**356**	**212**	**409.5**	**977.5**
			total kcal/day	**2546.5**
	1132	474	940.5	

Finger food menu Wednesday

Wednesday Breakfast	CHO (g)	PRO (g)	FAT (g)	Kcal
Orange Juice	12	1	0	52
2% Milk	12	8	5	125
Banana Muffin	36	3	6	210
Grapes 1 c	16	0	0	64
Bacon 2 slices	0	2	4	44
Hardboiled Egg	1	6	5	73
String cheese	1	8	1.5	49.5
Graham crackers	16	2	2	90
Total (g)	**94**	**30**	**23.5**	
Total Kcal	**376**	**120**	**211.5**	**707.5**

Wednesday Lunch	CHO (g)	PRO (g)	FAT (g)	Kcal
Grape Juice	21	1	0	88
2% Milk	12	8	5	125
Grilled Cheese Sandwich	26	17	22	370
Banana 1/2	13	1	0	56
Relish Plate	5	2	0	28
Apple Wedges	21	0	0	84
Ranch dressing	1	1	6	62
Van wafers (3)	11	1	2	66
Total (g)	**110**	**31**	**35**	
Total Kcal	**440**	**124**	**315**	**879**

Wednesday Dinner	CHO (g)	PRO (g)	FAT (g)	Kcal
Grape Juice	21	1	0	88
2% Milk	12	8	5	125
Chicken Quesadillas (1/2)	32	19	22.5	406.5
Watermelon 1 c	12	1	0	52
Relish plate	5	2	0	28
Ranch	1	1	6	62
Frosted animal cookies	37	2	15	291
Total (g)	**120**	**34**	**48.5**	
Total Kcal	**480**	**136**	**436.5**	**1052.5**
			Total kcal/day	**2639**
	1296	380	963	

Finger food menu Thursday

Thursday Breakfast	CHO (g)	PRO (g)	FAT (g)	Kcal
Orange Juice	21	1	0	88
2% Milk	12	8	5	125
power bar	20	10	10	210
Sausage patty 2 oz	0	8	15	167
country biscuit	32	10	3	195
Banana 1/2	13	1	0	56
Total (g)	**98**	**38**	**33**	
Total Kcal	**392**	**152**	**297**	**841**

Thursday Lunch	CHO (g)	PRO (g)	FAT (g)	Kcal
Cranberry Juice	17	0	0	68
2% Milk	12	8	5	125
Fish Sticks	18	15	16	276
potato russettes	17	3	10	170
Double Fudge Brownies	35	1	9	225
Total (g)	**99**	**27**	**40**	
Total Kcal	**424**	**108**	**351**	**883**

Thursday Dinner	CHO (g)	PRO (g)	FAT (g)	
Grape Juice	21	1	0	88
2% Milk	12	8	5	125
Chicken Strips 4	15	14	12	224
Tillamook Cheese	0	5.3	7	84.2
French Fries 10	17	2	4	112
Apple Wedges	21	0	0	84
Cookie of the Day	21	2	8	164
Total	**107**	**32.3**	**36**	
Total Kcal	**428**	**129.2**	**324**	**881.2**
			Total kcals/day	**2605.2**
	1244	389.2	972	

Finger food menu Friday

Friday Breakfast	CHO (g)	PRO (g)	FAT (g)	Kcal
Orange Juice	12	1	0	52
2% Milk	12	8	5	125
Banana muffin	36	3	6	210
sausage patty 2 oz	0	4	6	70
Hard boiled egg	1	6	5	73
Graham cracker (1 pkg)	16	2	2	90
Grapes 1 c	16	0	0	64
Total (g)	**93**	**24**	**24**	
Total Kcal	**372**	**96**	**216**	**684**

Friday Lunch	CHO (g)	PRO (g)	FAT (g)	Kcal
Apple Juice	15	0	0	60
2% Milk	12	8	5	125
PB& J Sandwich	43	10	10	302
Doritos	17	2	7	139
Banana 1/2	13	1	0	56
Gingersnaps 3	10	1	2	62
Total (g)	**110**	**22**	**24**	
Total Kcal	**440**	**88**	**216**	**744**

Friday Dinner	CHO (g)	PRO (g)	FAT (g)	
Apple Juice	15	0	0	60
2% Milk	12	8	5	125
Hamburger	24	32	23	431
potato russettes	17	3	10	189
Apple Wedges	21	0	0	84
Van waffers 3	11	1	2	66
Total (g)	**107**	**44**	**39**	
Total Kcal	**428**	**176**	**351**	**955**
			Total kcals/day	**2383**
	1240	360	783	

Finger food menu Saturday

Saturday Breakfast	CHO (g)	PRO (g)	FAT (g)	Kcal
Orange Juice	12	1	0	52
2% Milk	12	8	5	125
Banana 1/2	13	1	0	56
Raisin Muffin	26	3	8	188
Power bar	20	10	10	210
Hard boiled egg	1	6	5	73
Total (g)	**84**	**29**	**28**	
Total Kcal	**336**	**116**	**252**	**704**

Saturday Lunch	CHO (g)	PRO (g)	FAT (g)	Kcal
Cranapple Juice	16	0	0	64
2% Milk	12	8	5	125
Turkey Sandwich	25	16	3	191
Barbecue Chips	23	2	14	226
Relish plate	5	2	0	28
Ranch	1	1	6	62
Watermelon 1 c	12	1	0	52
Choc chip cookies (2)	40	1	11	263
Total (g)	**134**	**31**	**39**	
Total Kcal	**536**	**124**	**351**	**1011**

Saturday Dinner	CHO (g)	PRO (g)	FAT (g)	Kcal
Apple Juice	15	0	0	60
2% Milk	12	8	5	125
Hamburger	24	32	23	431
French Fries 10	17	2	4	112
Tillamook Cheese	0	5.3	7	84.2
Grapes 1 c	16	0	0	64
Vanilla Wafers	11	1	2	66
Total (g)	**95**	**48.3**	**41**	
Total Kcal	**380**	**193.2**	**369**	**942.2**
			Total kcal/day	**2657.2**
	1252	433.2	972	

Appendix C: Statistical variables and tables

Appendix C Table 1. Statistical Variables

Statistical Variables

Diet Type (A or B)
Meal type (breakfast, lunch, dinner, or other)
Percent of the meal eaten (quartile 1, 2, 3, or 4)
Calories eaten at meal
Average calories per day
Average calories per meal
Grams of protein at meal
Grams of carbohydrate at meal
Grams of fat at meal
Type of injury (focal or diffuse)
Albumin (g/dL)
Prealbumin (g/L)
CRP
Age
Gender
BMI
Whether patients ate a full meal (yes/no)
Non-liquid calories

Appendix C Table 2. Independent T tests for diet type vs. all continuous variables

Independent Samples Test - Diet type (standard or study) vs. continuous variables

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
kcals eaten/meal	Equal variances assumed	.139	.711	-.150	57	.881	-8.96991	59.68792	-128.493	110.55309
	Equal variances not assumed			-.150	54.707	.881	-8.96991	59.85174	-128.930	110.99010
Avg. kcal/day	Equal variances assumed	.385	.538	.350	57	.727	33.017	94.220	-155.656	221.690
	Equal variances not assumed			.347	52.976	.730	33.017	95.067	-157.665	223.700
Avg kcal/meal	Equal variances assumed	.072	.789	.107	57	.915	3.782	35.226	-66.756	74.321
	Equal variances not assumed			.107	55.571	.915	3.782	35.187	-66.718	74.283
grams pro/meal	Equal variances assumed	.481	.491	.805	57	.424	2.60417	3.23647	-3.87675	9.08508
	Equal variances not assumed			.821	56.790	.415	2.60417	3.17288	-3.74992	8.95825
grams cho/meal	Equal variances assumed	1.025	.316	-.710	57	.480	-4.88044	6.87106	-18.63950	8.87862
	Equal variances not assumed			-.694	47.649	.491	-4.88044	7.03733	-19.03264	9.27176
grams fat/meal	Equal variances assumed	1.066	.306	.373	57	.710	1.07755	2.88647	-4.70252	6.85761
	Equal variances not assumed			.380	56.900	.705	1.07755	2.83420	-4.59805	6.75315
albumin	Equal variances assumed	.040	.842	.100	33	.921	.00500	.05008	-.09690	.10690
	Equal variances not assumed			.100	30.359	.921	.00500	.05006	-.09719	.10719
prealbumin	Equal variances assumed	.031	.861	.155	35	.878	3.45833	22.33925	-41.89275	48.80942
	Equal variances not assumed			.155	32.487	.878	3.45833	22.33070	-42.00110	48.91776
CRP	Equal variances assumed	.000	1.000	.000	22	1.000	.00000	26.35783	-54.66279	54.66279
	Equal variances not assumed			.000	19.353	1.000	.00000	26.42969	-55.24970	55.24970
Age	Equal variances assumed	1.160	.286	-.711	57	.480	-2.632	3.704	-10.048	4.784
	Equal variances not assumed			-.703	52.406	.485	-2.632	3.744	-10.143	4.879
BMI	Equal variances assumed	.104	.750	-.253	23	.802	-.747	2.947	-6.842	5.349
	Equal variances not assumed			-.253	21.362	.803	-.747	2.956	-6.887	5.394
non-liquid kcals	Equal variances assumed	.664	.418	-.773	57	.443	-35.53889	45.98445	-127.621	56.54338
	Equal variances not assumed			-.785	56.994	.436	-35.53889	45.27244	-126.196	55.11781

Appendix C Table 3. One-way ANOVA for meal type vs. continuous variables

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) meal type	(J) meal type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
kcals eaten/meal	breakfast	lunch	-7.01003	67.03939	.994	-168.4116	154.3916
		dinner	-193.11529*	67.03939	.015	-354.5169	-31.7137
	lunch	breakfast	7.01003	67.03939	.994	-154.3916	168.4116
		dinner	-186.10526*	68.69493	.024	-351.4927	-20.7179
	dinner	breakfast	193.11529*	67.03939	.015	31.7137	354.5169
		lunch	186.10526*	68.69493	.024	20.7179	351.4927
Avg. kcal/day	breakfast	lunch	-29.642	114.821	.964	-306.08	246.80
		dinner	-78.115	114.821	.776	-354.55	198.32
	lunch	breakfast	29.642	114.821	.964	-246.80	306.08
		dinner	-48.474	117.657	.911	-331.74	234.79
	dinner	breakfast	78.115	114.821	.776	-198.32	354.55
		lunch	48.474	117.657	.911	-234.79	331.74
Avg kcal/meal	breakfast	lunch	-.852	42.967	1.000	-104.30	102.59
		dinner	-19.484	42.967	.893	-122.93	83.96
	lunch	breakfast	.852	42.967	1.000	-102.59	104.30
		dinner	-18.632	44.028	.906	-124.63	87.37
	dinner	breakfast	19.484	42.967	.893	-83.96	122.93
		lunch	18.632	44.028	.906	-87.37	124.63
grams pro/meal	breakfast	lunch	-.68296	3.45406	.979	-8.9988	7.6329
		dinner	-13.31454*	3.45406	.001	-21.6304	-4.9987
	lunch	breakfast	.68296	3.45406	.979	-7.6329	8.9988
		dinner	-12.63158*	3.53936	.002	-21.1528	-4.1104
	dinner	breakfast	13.31454*	3.45406	.001	4.9987	21.6304
		lunch	12.63158*	3.53936	.002	4.1104	21.1528
grams cho/meal	breakfast	lunch	-2.63534	8.27234	.946	-22.5515	17.2808
		dinner	-11.90376	8.27234	.328	-31.8199	8.0124
	lunch	breakfast	2.63534	8.27234	.946	-17.2808	22.5515
		dinner	-9.26842	8.47663	.522	-29.6764	11.1396
	dinner	breakfast	11.90376	8.27234	.328	-8.0124	31.8199
		lunch	9.26842	8.47663	.522	-11.1396	29.6764
grams fat/meal	breakfast	lunch	.40476	3.10397	.991	-7.0682	7.8778
		dinner	-10.91103*	3.10397	.002	-18.3840	-3.4380
	lunch	breakfast	-.40476	3.10397	.991	-7.8778	7.0682
		dinner	-11.31579*	3.18063	.002	-18.9733	-3.6582
	dinner	breakfast	10.91103*	3.10397	.002	3.4380	18.3840
		lunch	11.31579*	3.18063	.002	3.6582	18.9733
albumin	breakfast	lunch	.01818	.06169	.953	-.1334	.1698
		dinner	-.02500	.06033	.910	-.1733	.1233
	lunch	breakfast	-.01818	.06169	.953	-.1698	.1334
		dinner	-.04318	.06169	.765	-.1948	.1084
	dinner	breakfast	.02500	.06033	.910	-.1233	.1733
		lunch	.04318	.06169	.765	-.1084	.1948
prealbumin	breakfast	lunch	3.98601	27.85553	.989	-64.2722	72.2442
		dinner	-11.23077	26.66964	.907	-76.5830	54.1215
	lunch	breakfast	-3.98601	27.85553	.989	-72.2442	64.2722
		dinner	-15.21678	27.85553	.849	-83.4750	53.0414
	dinner	breakfast	11.23077	26.66964	.907	-54.1215	76.5830
		lunch	15.21678	27.85553	.849	-53.0414	83.4750
CRP	breakfast	lunch	8.70714	33.54372	.964	-75.8422	93.2564
		dinner	-6.77222	31.49327	.975	-86.1532	72.6088
	lunch	breakfast	-8.70714	33.54372	.964	-93.2564	75.8422
		dinner	-15.47937	32.66249	.884	-97.8075	66.8487
	dinner	breakfast	6.77222	31.49327	.975	-72.6088	86.1532
		lunch	15.47937	32.66249	.884	-66.8487	97.8075
Age	breakfast	lunch	.266	4.545	.998	-10.68	11.21
		dinner	1.160	4.545	.965	-9.78	12.10
	lunch	breakfast	-.266	4.545	.998	-11.21	10.68
		dinner	.895	4.657	.980	-10.32	12.11
	dinner	breakfast	-1.160	4.545	.965	-12.10	9.78
		lunch	-.895	4.657	.980	-12.11	10.32
BMI	breakfast	lunch	-.105	3.748	1.000	-9.52	9.31
		dinner	1.656	3.506	.885	-7.15	10.46
	lunch	breakfast	.105	3.748	1.000	-9.31	9.52
		dinner	1.760	3.748	.886	-7.66	11.18
	dinner	breakfast	-1.656	3.506	.885	-10.46	7.15
		lunch	-1.760	3.748	.886	-11.18	7.66
non-liquid kcals	breakfast	lunch	75.88897	51.91234	.317	-49.0933	200.8712
		dinner	-94.85840	51.91234	.170	-219.8406	30.1238
	lunch	breakfast	-75.88897	51.91234	.317	-200.8712	49.0933
		dinner	-170.74737*	53.19431	.006	-298.8161	-42.6787
	dinner	breakfast	94.85840	51.91234	.170	-30.1238	219.8406
		lunch	170.74737*	53.19431	.006	42.6787	298.8161

*. The mean difference is significant at the .05 level.

Appendix C Table 4. Independent t tests for full meal (yes or no) vs. continuous variables

Independent Samples Test - Full meal (yes or no) vs. continuous variables

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
kcals eaten/mea	Equal variances assumed	.877	.353	-6.145	57	.000	352.16844	57.30620	-466.922	-237.415
	Equal variances not assumed			-7.385	22.738	.000	352.16844	47.68790	-450.881	-253.456
Avg. kcal/day	Equal variances assumed	36.846	.000	-2.468	57	.017	-273.810	110.966	-496.017	-51.604
	Equal variances not assumed			-3.427	31.572	.002	-273.810	79.888	-436.624	-110.997
Avg kcal/meal	Equal variances assumed	71.346	.000	-2.525	57	.014	-104.429	41.352	-187.235	-21.624
	Equal variances not assumed			-3.423	29.649	.002	-104.429	30.512	-166.774	-42.084
grams pro/meal	Equal variances assumed	.002	.963	-4.073	57	.000	-14.44149	3.54539	-21.54100	-7.34198
	Equal variances not assumed			-4.019	16.787	.001	-14.44149	3.59372	-22.03091	-6.85207
grams cho/meal	Equal variances assumed	1.587	.213	-4.712	57	.000	-34.14326	7.24652	-48.65417	-19.63235
	Equal variances not assumed			-3.920	14.166	.002	-34.14326	8.70959	-52.80295	-15.48358
grams fat/meal	Equal variances assumed	.539	.466	-4.380	57	.000	-13.55142	3.09402	-19.74708	-7.35576
	Equal variances not assumed			-4.191	16.199	.001	-13.55142	3.23374	-20.39982	-6.70301
albumin	Equal variances assumed	.153	.698	-.212	33	.833	-.01250	.05899	-.13252	.10752
	Equal variances not assumed			-.203	10.840	.843	-.01250	.06150	-.14811	.12311
prealbumin	Equal variances assumed	.007	.934	-1.098	35	.280	-30.50476	27.79257	-86.92668	25.91716
	Equal variances not assumed			-1.139	9.423	.283	-30.50476	26.78170	-90.67730	29.66778
CRP	Equal variances assumed	.158	.695	.432	22	.670	12.29244	28.46870	-46.74804	71.33291
	Equal variances not assumed			.425	10.858	.679	12.29244	28.94638	-51.51958	76.10445
Age	Equal variances assumed	4.005	.050	-1.501	57	.139	-6.778	4.516	-15.821	2.264
	Equal variances not assumed			-1.279	14.447	.221	-6.778	5.302	-18.116	4.560
BMI	Equal variances assumed	.484	.493	-.299	23	.768	-.972	3.256	-7.708	5.763
	Equal variances not assumed			-.294	10.674	.774	-.972	3.304	-8.272	6.328
non-liquid kcals	Equal variances assumed	.214	.645	-3.147	57	.003	166.20816	52.80751	-271.953	-60.46294
	Equal variances not assumed			-3.311	18.256	.004	166.20816	50.19127	-271.550	-60.86600

Appendix C Table 5. One-way ANOVA for meal type vs. continuous variables for standard diet

Multiple Comparisons - Standard Diet

Tukey HSD

Dependent Variable	(I) meal type	(J) meal type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
kcals eaten/meal	breakfast	lunch	-46.40000	84.32775	.847	-254.6598	161.8598
		dinner	-288.63333*	80.73768	.003	-488.0269	-89.2397
	lunch	breakfast	46.40000	84.32775	.847	-161.8598	254.6598
		dinner	-242.23333*	80.73768	.015	-441.6269	-42.8397
	dinner	breakfast	288.63333*	80.73768	.003	89.2397	488.0269
		lunch	242.23333*	80.73768	.015	42.8397	441.6269
Avg. kcal/day	breakfast	lunch	12.400	158.519	.997	-379.09	403.89
		dinner	17.117	151.770	.993	-357.70	391.94
	lunch	breakfast	-12.400	158.519	.997	-403.89	379.09
		dinner	4.717	151.770	.999	-370.10	379.54
	dinner	breakfast	-17.117	151.770	.993	-391.94	357.70
		lunch	-4.717	151.770	.999	-379.54	370.10
Avg kcal/meal	breakfast	lunch	3.700	62.681	.998	-151.10	158.50
		dinner	5.783	60.013	.995	-142.43	153.99
	lunch	breakfast	-3.700	62.681	.998	-158.50	151.10
		dinner	2.083	60.013	.999	-146.13	150.29
	dinner	breakfast	-5.783	60.013	.995	-153.99	142.43
		lunch	-2.083	60.013	.999	-150.29	146.13
grams pro/meal	breakfast	lunch	-4.70000	5.40945	.664	-18.0594	8.6594
		dinner	-15.91667*	5.17916	.012	-28.7074	-3.1260
	lunch	breakfast	4.70000	5.40945	.664	-8.6594	18.0594
		dinner	-11.21667	5.17916	.094	-24.0074	1.5740
	dinner	breakfast	15.91667*	5.17916	.012	3.1260	28.7074
		lunch	11.21667	5.17916	.094	-1.5740	24.0074
grams cho/meal	breakfast	lunch	-3.75000	9.90266	.924	-28.2061	20.7061
		dinner	-16.43333	9.48108	.210	-39.8482	6.9816
	lunch	breakfast	3.75000	9.90266	.924	-20.7061	28.2061
		dinner	-12.68333	9.48108	.386	-36.0982	10.7316
	dinner	breakfast	16.43333	9.48108	.210	-6.9816	39.8482
		lunch	12.68333	9.48108	.386	-10.7316	36.0982
grams fat/meal	breakfast	lunch	-2.40000	4.25637	.840	-12.9117	8.1117
		dinner	-16.88333*	4.07516	.001	-26.9475	-6.8191
	lunch	breakfast	2.40000	4.25637	.840	-8.1117	12.9117
		dinner	-14.48333*	4.07516	.004	-24.5475	-4.4191
	dinner	breakfast	16.88333*	4.07516	.001	6.8191	26.9475
		lunch	14.48333*	4.07516	.004	4.4191	24.5475
albumin	breakfast	lunch	-.01429	.08564	.985	-.2340	.2054
		dinner	-.04286	.08228	.862	-.2539	.1682
	lunch	breakfast	.01429	.08564	.985	-.2054	.2340
		dinner	-.02857	.08564	.941	-.2483	.1911
	dinner	breakfast	.04286	.08228	.862	-.1682	.2539
		lunch	.02857	.08564	.941	-.1911	.2483
prealbumin	breakfast	lunch	-3.90476	39.48171	.995	-104.6685	96.8590
		dinner	-7.32143	36.72828	.978	-101.0580	86.4151
	lunch	breakfast	3.90476	39.48171	.995	-96.8590	104.6685
		dinner	-3.41667	38.32590	.996	-101.2306	94.3973
	dinner	breakfast	7.32143	36.72828	.978	-86.4151	101.0580
		lunch	3.41667	38.32590	.996	-94.3973	101.2306
CRP	breakfast	lunch	-12.19000	45.46248	.961	-134.9776	110.5976
		dinner	-24.38000	42.86243	.839	-140.1453	91.3853
	lunch	breakfast	12.19000	45.46248	.961	-110.5976	134.9776
		dinner	-12.19000	45.46248	.961	-134.9776	110.5976
	dinner	breakfast	24.38000	42.86243	.839	-91.3853	140.1453
		lunch	12.19000	45.46248	.961	-110.5976	134.9776
Age	breakfast	lunch	-3.700	6.120	.819	-18.81	11.41
		dinner	-3.083	5.860	.859	-17.55	11.39
	lunch	breakfast	3.700	6.120	.819	-11.41	18.81
		dinner	.617	5.860	.994	-13.85	15.09
	dinner	breakfast	3.083	5.860	.859	-11.39	17.55
		lunch	-.617	5.860	.994	-15.09	13.85
BMI	breakfast	lunch	1.410	5.202	.960	-12.64	15.46
		dinner	2.760	4.904	.842	-10.49	16.01
	lunch	breakfast	-1.410	5.202	.960	-15.46	12.64
		dinner	1.350	5.202	.964	-12.70	15.40
	dinner	breakfast	-2.760	4.904	.842	-16.01	10.49
		lunch	-1.350	5.202	.964	-15.40	12.70
non-liquid kcals	breakfast	lunch	-17.90000	74.57071	.969	-202.0634	166.2634
		dinner	-211.61667*	71.39602	.016	-387.9397	-35.2937
	lunch	breakfast	17.90000	74.57071	.969	-166.2634	202.0634
		dinner	-193.71667*	71.39602	.029	-370.0397	-17.3937
	dinner	breakfast	211.61667*	71.39602	.016	35.2937	387.9397
		lunch	193.71667*	71.39602	.029	17.3937	370.0397

*. The mean difference is significant at the .05 level.

Appendix C Table 6. One-way ANOVA for meal type vs. continuous variables for study diet

Multiple Comparisons - Study Diet

Tukey HSD

Dependent Variable	(I) meal type	(J) meal type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
kcals eaten/meal	breakfast	lunch	24.15152	106.92178	.972	-242.8629	291.1659
		dinner	-79.61039	115.01637	.770	-366.8393	207.6185
	lunch	breakfast	-24.15152	106.92178	.972	-291.1659	242.8629
		dinner	-103.76190	119.88325	.667	-403.1448	195.6210
	dinner	breakfast	79.61039	115.01637	.770	-207.6185	366.8393
		lunch	103.76190	119.88325	.667	-195.6210	403.1448
Avg. kcal/day	breakfast	lunch	-64.212	174.195	.928	-499.23	370.80
		dinner	-192.974	187.383	.566	-660.92	274.98
	lunch	breakfast	64.212	174.195	.928	-370.80	499.23
		dinner	-128.762	195.312	.789	-616.51	358.99
	dinner	breakfast	192.974	187.383	.566	-274.98	660.92
		lunch	128.762	195.312	.789	-358.99	616.51
Avg kcal/meal	breakfast	lunch	-3.566	61.675	.998	-157.58	150.45
		dinner	-53.455	66.344	.703	-219.13	112.22
	lunch	breakfast	3.566	61.675	.998	-150.45	157.58
		dinner	-49.889	69.151	.753	-222.58	122.80
	dinner	breakfast	53.455	66.344	.703	-112.22	219.13
		lunch	49.889	69.151	.753	-122.80	222.58
grams pro/meal	breakfast	lunch	3.42929	4.33230	.712	-7.3897	14.2483
		dinner	-10.25325	4.66028	.092	-21.8913	1.3848
	lunch	breakfast	-3.42929	4.33230	.712	-14.2483	7.3897
		dinner	-13.68254*	4.85748	.025	-25.8131	-1.5520
	dinner	breakfast	10.25325	4.66028	.092	-1.3848	21.8913
		lunch	13.68254*	4.85748	.025	1.5520	25.8131
grams cho/meal	breakfast	lunch	-2.38384	13.98856	.984	-37.3173	32.5496
		dinner	-8.07273	15.04757	.854	-45.6508	29.5054
	lunch	breakfast	2.38384	13.98856	.984	-32.5496	37.3173
		dinner	-5.68889	15.68430	.930	-44.8571	33.4793
	dinner	breakfast	8.07273	15.04757	.854	-29.5054	45.6508
		lunch	5.68889	15.68430	.930	-33.4793	44.8571
grams fat/meal	breakfast	lunch	2.87374	4.40584	.793	-8.1289	13.8764
		dinner	-3.25325	4.73938	.774	-15.0888	8.5824
	lunch	breakfast	-2.87374	4.40584	.793	-13.8764	8.1289
		dinner	-6.12698	4.93993	.442	-18.4634	6.2094
	dinner	breakfast	3.25325	4.73938	.774	-8.5824	15.0888
		lunch	6.12698	4.93993	.442	-6.2094	18.4634
albumin	breakfast	lunch	.06000	.09798	.816	-.2014	.3214
		dinner	.00000	.09798	1.000	-.2614	.2614
	lunch	breakfast	-.06000	.09798	.816	-.3214	.2014
		dinner	-.06000	.09798	.816	-.3214	.2014
	dinner	breakfast	.00000	.09798	1.000	-.2614	.2614
		lunch	.06000	.09798	.816	-.2014	.3214
prealbumin	breakfast	lunch	13.46667	42.94181	.947	-99.9185	126.8518
		dinner	-17.33333	42.94181	.915	-130.7185	96.0518
	lunch	breakfast	-13.46667	42.94181	.947	-126.8518	99.9185
		dinner	-30.80000	44.85125	.775	-149.2269	87.6269
	dinner	breakfast	17.33333	42.94181	.915	-96.0518	130.7185
		lunch	30.80000	44.85125	.775	-87.6269	149.2269
CRP	breakfast	lunch	40.63333	57.46421	.767	-128.6021	209.8688
		dinner	20.31667	53.75285	.925	-137.9886	178.6219
	lunch	breakfast	-40.63333	57.46421	.767	-209.8688	128.6021
		dinner	-20.31667	53.75285	.925	-178.6219	137.9886
	dinner	breakfast	-20.31667	53.75285	.925	-178.6219	137.9886
		lunch	20.31667	53.75285	.925	-137.9886	178.6219
Age	breakfast	lunch	3.869	6.988	.846	-13.58	21.32
		dinner	5.234	7.517	.768	-13.54	24.01
	lunch	breakfast	-3.869	6.988	.846	-21.32	13.58
		dinner	1.365	7.835	.983	-18.20	20.93
	dinner	breakfast	-5.234	7.517	.768	-24.01	13.54
		lunch	-1.365	7.835	.983	-20.93	18.20
BMI	breakfast	lunch	-2.083	6.268	.941	-19.99	15.83
		dinner	.275	5.803	.999	-16.31	16.86
	lunch	breakfast	2.083	6.268	.941	-15.83	19.99
		dinner	2.358	6.268	.926	-15.55	20.27
	dinner	breakfast	-.275	5.803	.999	-16.86	16.31
		lunch	-2.358	6.268	.926	-20.27	15.55
non-liquid kcals	breakfast	lunch	160.88586	65.58896	.055	-2.9086	324.6803
		dinner	28.72078	70.55442	.913	-147.4739	204.9154
	lunch	breakfast	-160.88586	65.58896	.055	-324.6803	2.9086
		dinner	-132.16508	73.53991	.192	-315.8153	51.4852
	dinner	breakfast	-28.72078	70.55442	.913	-204.9154	147.4739
		lunch	132.16508	73.53991	.192	-51.4852	315.8153

*. The mean difference is significant at the .05 level.

Appendix C Table 7. Independent t tests for full meal (yes or no) on the standard diet

Independent Samples Test - Standard Diet

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
kcals eaten/mea	Equal variances assumed	.941	.340	-3.604	30	.001	335.36296	93.05016	-525.397	-145.329
	Equal variances not assumed			-5.175	9.143	.001	335.36296	64.80641	-481.616	-189.110
Avg. kcal/day	Equal variances assumed	138.741	.000	-1.841	30	.076	-296.170	160.867	-624.705	32.364
	Equal variances not assumed			-3.850	28.257	.001	-296.170	76.925	-453.680	-138.661
Avg kcal/meal	Equal variances assumed	198.555	.000	-1.875	30	.071	-119.022	63.487	-248.679	10.635
	Equal variances not assumed			-4.058	29.821	.000	-119.022	29.327	-178.932	-59.113
grams pro/meal	Equal variances assumed	.216	.646	-4.073	30	.000	-22.00000	5.40105	33.03042	10.96958
	Equal variances not assumed			-3.709	5.203	.013	-22.00000	5.93142	37.07010	-6.92990
grams cho/meal	Equal variances assumed	.278	.602	-1.863	30	.072	-19.75185	10.60467	41.40949	1.90578
	Equal variances not assumed			-2.228	6.756	.063	-19.75185	8.86702	40.87378	1.37008
grams fat/meal	Equal variances assumed	.170	.683	-3.331	30	.002	-16.97037	5.09504	27.37584	-6.56490
	Equal variances not assumed			-3.681	6.151	.010	-16.97037	4.61022	28.18424	-5.75650
albumin	Equal variances assumed	.017	.898	.062	18	.951	.00588	.09444	-.19254	.20430
	Equal variances not assumed			.055	2.542	.960	.00588	.10623	-.36944	.38120
prealbumin	Equal variances assumed	.318	.580	-.326	19	.748	-14.00000	43.00233	-104.005	76.00492
	Equal variances not assumed			-.329	2.734	.766	-14.00000	42.56790	-157.236	29.23587
CRP	Equal variances assumed	.774	.396	.612	12	.552	25.85758	42.22524	66.14333	17.85848
	Equal variances not assumed			.575	2.963	.606	25.85758	44.93871	-118.183	69.89824
Age	Equal variances assumed	4.385	.045	-1.648	30	.110	-10.415	6.319	-23.320	2.490
	Equal variances not assumed			-1.185	4.588	.294	-10.415	8.787	-33.626	12.796
BMI	Equal variances assumed	.691	.422	-.623	12	.545	-3.006	4.827	-13.524	7.512
	Equal variances not assumed			-.583	2.951	.601	-3.006	5.156	-19.569	13.557
non-liquid kcals	Equal variances assumed	.106	.747	-2.525	30	.017	215.28889	85.27933	-389.453	41.12527
	Equal variances not assumed			-2.990	6.672	.021	215.28889	71.99559	-387.242	43.33623

Appendix C Table 8. Independent t tests for full meal (yes or no) vs. continuous variables for study diet

Independent Samples Test - Study Diet

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
kcals eaten/mea	Equal variances assumed	.088	.769	-5.165	25	.000	373.78571	72.37597	-522.847	-224.725
	Equal variances not assumed			-5.317	11.104	.000	373.78571	70.30279	-528.345	-219.226
Avg. kcal/day	Equal variances assumed	7.940	.009	-1.694	25	.103	-273.429	161.409	-605.856	58.999
	Equal variances not assumed			-2.055	16.015	.057	-273.429	133.058	-555.477	8.620
Avg kcal/meal	Equal variances assumed	13.873	.001	-1.706	25	.100	-96.786	56.739	-213.642	20.070
	Equal variances not assumed			-1.950	13.854	.072	-96.786	49.633	-203.343	9.772
grams pro/meal	Equal variances assumed	2.664	.115	-2.141	25	.042	-9.48214	4.42941	18.60469	-.35960
	Equal variances not assumed			-2.953	22.106	.007	-9.48214	3.21112	16.13974	-2.82454
grams cho/meal	Equal variances assumed	3.856	.061	-4.572	25	.000	-45.45571	9.94285	65.93339	24.97804
	Equal variances not assumed			-3.537	7.463	.009	-45.45571	12.85078	75.46477	15.44665
grams fat/meal	Equal variances assumed	1.128	.298	-3.110	25	.005	-11.48929	3.69482	19.09891	-3.87966
	Equal variances not assumed			-2.675	8.397	.027	-11.48929	4.29569	21.31418	-1.66440
albumin	Equal variances assumed	.406	.535	-.362	13	.723	-.03000	.08279	-.20885	.14885
	Equal variances not assumed			-.346	7.230	.739	-.03000	.08660	-.23347	.17347
prealbumin	Equal variances assumed	.114	.741	-1.227	14	.240	-46.83333	38.16745	-128.694	35.02770
	Equal variances not assumed			-1.202	5.007	.283	-46.83333	38.96615	-146.957	53.29056
CRP	Equal variances assumed	.	.	.000	8	1.000	.00000	43.98687	-101.434	01.43391
	Equal variances not assumed			.000	6.316	1.000	.00000	44.51159	-107.609	07.60937
Age	Equal variances assumed	.358	.555	-.483	25	.633	-3.257	6.737	-17.132	10.618
	Equal variances not assumed			-.450	9.350	.663	-3.257	7.244	-19.552	13.037
BMI	Equal variances assumed	.000	.995	.231	9	.822	1.129	4.884	-9.920	12.177
	Equal variances not assumed			.227	6.058	.828	1.129	4.968	-10.999	13.256
non-liquid kcals	Equal variances assumed	.009	.926	-1.818	25	.081	120.91714	66.50112	-257.879	16.04448
	Equal variances not assumed			-1.705	9.466	.121	120.91714	70.92740	-280.171	38.33626

Appendix D: The Rancho Los Amigos Scale

The Rancho Los Amigos Scale

I. No Response
Patient appears to be in a deep sleep and is unresponsive to stimuli.

II. Generalized Response
Patient reacts inconsistently and non purposefully to stimuli in a non specific manner. Reflexes) are limited and often the same, regardless of stimuli presented.

III. Localized Response
Patient responses are specific but inconsistent, and are directly related to the type of stimulus presented, such as turning head toward a sound or focusing on a presented object. He may follow Simple commands in an inconsistent and delayed manner.

IV. Confused-Agitated
Patient is in a heightened state of activity and severely confused, disoriented, and unaware of present events. His behavior is frequently bizarre and inappropriate to his immediate environment. He is unable to perform self-care. If not physically disabled, he may perform automatic motor activities such as sitting, reaching and walking as part of his agitated state, but not necessarily as a purposeful act.

V. Confused-Inappropriate, Non-Agitated
Patient appears alert and responds to simple commands. More complex commands, however, produce responses that are non purposeful and random. The patient may show some agitated behavior it is in response to external stimuli rather than internal confusion. The patient is highly distractible and generally has difficulty in learning new information. He can manage self-care activities with assistance. His memory is impaired and verbalization is often inappropriate.

VI. Confused-Appropriate
Patient shows goal-directed behavior, but relies on cuing for direction. He can relearn old skills such as activities of daily living, but memory problems interfere with new learning. He has a beginning awareness of self and others.

VII. Automatic Appropriate
Patient goes through daily routine automatically, but is robot like with appropriate behavior and minimal confusion. He has shallow recall of activities, and superficial awareness of, but lack of insight to, his condition. He requires at least minimal supervision because judgment, problem solving, and planning skills are impaired.

VIII. Purposefull~ Appropriate
Patient is alert and oriented, and is able to recall and integrate past and recent events. He can learn new activities and continue in home and living skills, though deficits in stress tolerance, judgment, abstract reasoning, social, emotional, and intellectual capacities may persist.