

**THE RELATIONSHIP BETWEEN  
REGULAR BREAKFAST CONSUMPTION  
AND BODY MASS INDEX IN YOUNG ADULTS**

By

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## **Abstract**

In recent decades, obesity has developed into a serious health concern. Many factors have been examined in the study of obesity, one of which is breakfast consumption patterns. The purpose of this study was to a) determine the relationship between body mass index (BMI) and breakfast intake in young adults, b) determine the effects of macronutrient consumption on total daily energy intake, and c) determine the relationship between ready-to-eat cereal consumption during breakfast and BMI.

Data used to conduct this study were taken from a parent study, the Jayhawk Observed Eating Trial. The sample consisted of 267 participants recruited from the University of Kansas. Individuals were observed over a 12-week period. Anthropometric data were collected at baseline, 6, and 12 weeks. Participants were required to eat a certain number of meals at university dining halls. Their dietary intakes were recorded using picture plate waste (PPW) and dietary recalls. Dietary intakes were entered into NDSR. Mixed modeling analysis and general linear modeling were used for data analyses.

Significant associations were found between percent breakfast consumption and BMI and percent fat consumed at breakfast and total daily energy intake. No association was found between total daily energy intake and percent protein or percent carbohydrate consumed at breakfast. Also, no significant association was found between ready-to-eat cereal consumption at breakfast and BMI.

These findings indicate that breakfast consumption and breakfast type may have an impact on BMI and total daily energy intake in young adults. Therefore, young adults should consider consuming breakfast, especially a low fat breakfast, as a potential way to prevent future obesity.

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## Chapter 1: Introduction

The incidence of obesity among Americans has risen steadily since the 1980s (1). Although the rising trend has slowed, 68% of American adults are now obese or overweight (1). In order to examine the underlying causes of obesity, many researchers have investigated breakfast consumption as a potential factor. Both breakfast consumption and the type of breakfast consumed have been associated with decreased body mass index (BMI), weight maintenance, weight loss and nutritional status (2-6, 8, 10, 12). However, most studies focus on three age groups: children, adolescents, and adults. While a few studies (6, 8) were performed on young adults (adults aged 18-29), these studies do not specifically examine breakfast types or macronutrient composition of breakfasts.

Over the past two decades, the incidence of breakfast skipping has increased in the United States across all age groups. Among children, 20% skip breakfast (5). These rates increase with age, as over 30% of adolescents skip breakfast (5) and 37% of young adults skip breakfast (6). One of the reasons why breakfast consumption may be declining could be that many people are uneducated about the benefits of breakfast consumption.

Teenagers often skip breakfast because they believe that doing so will decrease their caloric intake and ultimately help them to control their weight (7). Level of education also impacts breakfast consumption: the greater the level of education of the parents, the more likely the child is to consume breakfast (8).

Although the quality of food consumed at breakfast has improved in nutritional value due to food fortification and public awareness, the increase in skipping breakfast counteracts any benefits due to breakfast quality (9). Skipping breakfast is associated with many negative health implications, including increased body weight. Research shows that

skipping breakfast correlates with increased BMI as well as a poorer diet among adults (4, 10). Breakfast skipping is also linked to increased chronic disease risk (diabetes mellitus, cardiovascular disease and cancer) and increased risk of death (10, 11).

Consuming breakfast correlates with numerous positive effects as well. Studies demonstrate that eating breakfast increases satiety and decreases appetite throughout the day (3, 24). Reduced dietary intake is also associated with consuming three meals a day versus two meals (12). Additionally, breakfast consumption leads to increased nutritional adequacy, especially with respect to school-aged children (8). Along with improved nutritional status, breakfast consumption has beneficial effects on weight status as well. Among nine and ten year old girls, the number of days eating breakfast is predictive of lower BMIs (13).

Other factors associated with breakfast consumption also influence weight and health. Breakfast type is an important indicator of BMI and energy intake. Some studies demonstrate that breakfast cereal consumption in both children and adults is associated with a lower BMI (3-4). As a weight loss method, cereal intake is even more effective when more than one type of cereal is consumed (14). Among the different types of breakfasts examined, meat and egg breakfasts correlate with the highest energy intakes and the highest BMIs, likely due to the high fat content of these breakfast types (3). Breakfast location also appears to influence daily intakes. Children who eat breakfast at school have fewer nutritional deficiencies than those who do not eat breakfast or those who eat at home (8). Additionally, children who do not eat breakfast at school or at home tend to purchase more unhealthy snacks during the day (15).

In conclusion, breakfast consumption has decreased significantly over the past thirty years, potentially contributing to the obesity epidemic (1). While considerable research has been performed on the breakfast consumption habits among children, adolescents, and adults, there has not been enough focus on the breakfast eating habits of young adults. Young adults in college are a vulnerable population for the development of obesity because they are often faced with the task of making their own decisions concerning food for the first time. During these years, they must learn to select and prepare their own meals with an often unstable and inconsistent schedule, which could lead to unplanned snacking, skipped meals, and poor food decisions. As young adults age and mature, their potentially bad breakfast habits could have serious health implications.

### Justification

To date, little clinical research has been performed on breakfast consumption habits among young adults. Current research within this population has focused solely on breakfast consumption patterns. For instance, some studies have demonstrated that breakfast consumption decreases from adolescence into young adulthood (6, 16). Research also shows that those young adults who skip breakfast have lower daily intakes of vitamins and minerals (6). More information is needed about the effects of eating specific foods during breakfast on BMI. While considerable amounts of data have been gathered for adults and children regarding how breakfast composition affects daily nutrient and energy intake, similar studies have yet to be performed on young adults.

### Primary Research Question

1. Is increased breakfast consumption associated with decreased body mass index (BMI) in young adults?

### Secondary Research Questions:

1. Does macronutrient consumption (protein, carbohydrate, fat) during breakfast influence total daily energy intake in young adults?
2. Is consumption of ready-to-eat breakfast cereals at breakfast associated with a lower BMI in comparison to consumption of other breakfast types?

## Chapter 2: Review of Literature

The incidence of obesity among Americans has risen steadily over the past several decades (1). In 2007-2008, 68% of American adults were considered to be either obese or overweight (17). Healthy weight adults are now in the minority (32%). The increase in incidence of obesity has occurred in the younger population as well (9). The 2007-2008 NHANES study (1) estimates that 33.6% of children and adolescents aged 2-19 years are either overweight or obese. The same study also estimates that 16.9% of children and adolescents aged 2-19 years are obese. Obesity is associated with increased morbidity and mortality, especially with respect to cardiovascular disease and diabetes (18). Obesity has also been linked to cancer, liver disease, kidney disease, and depression (18).

In order to examine the underlying causes of obesity, many researchers have looked at breakfast consumption as a potential factor. Breakfast consumption and the type of breakfast consumed are associated with body mass index (BMI) (2-3, 10), weight maintenance (4,12), weight loss (4,12), and nutritional status (2, 5-6, 8). Most breakfast consumption studies focus on three age groups: children, adolescents and adults. While a few studies (6,8) were performed among young adults aged 18 to 29, these studies do not specifically look at breakfast types or macronutrient composition of breakfasts. This age group has not been studied adequately and breakfast consumption patterns in young adults deserve more attention because studies have shown that early eating patterns often translate into lifetime habits (6). Young adults, especially those attending college, are often faced with a period of instability in their diet. Their choices for breakfast consumption have serious implications for their health. This literature review seeks to examine current research on breakfast consumption and its effects on weight, diet and health, especially

with respect to young adults. Since limited research has been conducted on breakfast consumption patterns of young adults, findings concerning other age groups are discussed within this review of literature.

### *Statistics and risks associated with breakfast skipping*

Over the past two decades, the incidence of breakfast skipping has increased in the United States across all age groups. Among children, 20% skip breakfast (5). As children age, these rates increase as over 30% of adolescents skip breakfast (5) and 37% of young adults skip breakfast (6). For adults, breakfast consumption has declined from 86% to 75% (10). There are many factors that may contribute to this high incidence of breakfast skipping. For instance, breakfast consumption increases with both education level and age, so younger people with lower education levels are more likely to skip breakfast (10). Additionally, people of low socioeconomic status are more likely to skip breakfast than others (7). Nevertheless, during recent years there have been some positive changes in breakfast consumption patterns. Fewer individuals are consuming unhealthy breakfasts containing ingredients such as whole milk and bacon (9). Although the quality of food consumed at breakfast has improved in nutritional value, the increase in skipping breakfast counteracts any total benefits due to improved breakfast quality (9).

Skipping breakfast is associated with many negative health implications. Research shows that skipping breakfast correlates with poorer diet quality, increased risk of obesity and increased chronic disease risk among adults (4, 10-12). One study even demonstrated an increased risk of death associated with breakfast skipping (18). These increased risks could be caused by the negative lifestyle choices breakfast skippers make involving food-

purchasing behaviors (15). Breakfast skippers often consume more energy-dense, high-fat foods in order to compensate for the calories they did not consume in the morning, leading to weight gain (10). Those who skip breakfast have reduced nutrient intakes of vitamin A, vitamin E, vitamin C, vitamin B-12, vitamin B-6, folate, iron, calcium, and phosphorus (5). Breakfast skippers also are less likely to meet daily recommendations of fruits and vegetables (15). Only 44.7% of breakfast skippers consumed their recommended amounts of fruits and vegetables as compared to 53.6% of breakfast consumers (15).

### *The benefits of breakfast consumption*

Consuming breakfast correlates with numerous positive effects, including improved weight management and weight maintenance (4, 12, 14). Breakfast skippers typically have higher BMIs than those who regularly consume breakfast (4, 5, 10). Over the course of a year, normal weight children who skipped breakfast gained more weight than their counterparts who consumed breakfast (an additional 0.21 kg/m<sup>2</sup> for girls and 0.08 kg/m<sup>2</sup> for boys) (19). Comparable results have been found in adults (17). In a clinical trial performed at Vanderbilt University (12), fifty-two moderately obese women were categorized as breakfast skippers or breakfast consumers and randomized to either a no-breakfast group or a breakfast group. For baseline breakfast skippers in this trial, those randomized to the breakfast treatment lost more weight than those who were randomized to the no-breakfast treatment (-7.7 kg vs. -6.0 kg, respectively;  $p > 0.06$ ). Results have been repeated in a similar clinical trial (4).

Several mechanisms have been proposed to explain the connection between breakfast consumption and decreased BMI. Consuming three meals per day demonstrates

improved distribution of energy intake (3). Those who consume two meals per day do not distribute their energy intake as well as those who consume three meals per day. Normal-weight and underweight individuals tend to distribute their energy intake more evenly throughout the day than overweight or obese individuals (12). Another study demonstrates that eating breakfast increases satiety and decreases appetite throughout the day (21), thus decreasing the incidence of unnecessary snacking. In general, current research presents convincing evidence that breakfast consumption is strongly related to maintaining and achieving a healthy body weight.

Breakfast consumption also leads to a host of benefits outside of nutritional status and weight management. For all age groups, breakfast consumption is associated with improved health status (10). In adults, breakfast consumption correlates with increased mental alertness, physical activity, and food-related self-control (4). For children, breakfast consumption can help to improve cognition and learning by improving attention and memory (11). By increasing meal frequency, breakfast consumers can reduce their risk of cardiovascular disease and diabetes mellitus through mechanisms of lipid metabolism, resulting in lower levels of fasting LDL and total cholesterol (18). Likewise, consumption of breakfast is associated with improved glucose metabolism via increased insulin sensitivity and glucose tolerance (19). Eating breakfast is also associated with a decrease in total and cardiovascular-related deaths (11).

### *The impact of breakfast type*

Other factors associated with breakfast consumption can influence weight and health status. Breakfast type is an important indicator of BMI and energy intake, since it



correlates with total caloric intake and macronutrient intake in the diet (4). In one study, researchers determined that among the different types of breakfasts examined, meat and egg breakfasts were positively correlated with energy intakes and BMIs (3). On average, meat and egg breakfast consumers had a daily energy intake of 2433.7 kcal while ready-to-eat cereal consumers had a daily energy intake of 2241.5 kcal.

A few studies have demonstrated that breakfast cereal consumption in both children and adults is associated with a lower BMI (3, 4). As a weight loss method, cereal consumption is even more effective when more than one type of cereal is consumed (14). In a clinical trial conducted by Lightowler and colleagues (14), ready to eat cereals were used as meal replacements for breakfast and lunch. For those in the variety cereal group, subjects were free to select one of three different types of cereal for each meal. They did not have to consume the same type of cereal during breakfast and lunch. While ready-to-eat cereals were successful in reducing weight for both groups, the group given different types of breakfast cereals lost more weight (-2.0 kg) than the group given just one type of breakfast cereal (-0.6 kg;  $p=0.023$ ). Since many forms of breakfast cereals are readily available for purchase, this could be a simple way to promote weight loss (14).

Cereal consumption also improves nutritional status. Those who consume ready-to-eat cereals also consume more fiber than those who do not eat breakfast or those who eat other types of breakfast (14.5 g versus 13.3 g, respectively;  $p<0.0167$ ) (5). Another benefit of cereal consumption is increased intake of whole grains (5). Those who eat cereal tend to obtain a lower percentage of their daily energy intake from fat (5). Ready to eat cereal consumers also obtain more vitamins and minerals, like vitamin A, vitamin C, vitamin B-6, vitamin B-12, thiamin, riboflavin, niacin, folate, calcium, phosphorus, magnesium, iron, zinc,

and potassium, than those who consume other types of breakfast (5). Breakfast consumers of ready-to-eat cereals typically eat a diet higher in carbohydrates and lower in fats, and these types of diets correlate with weight loss (3). A possible explanation for this effect could be that cereal displaces less healthy alternatives (2). Even though ready-to-eat cereal consumption is associated with the most nutritional benefits, fewer children and adolescents consumed cereal as opposed to other types of breakfast (5). Overall, breakfast cereals have proven themselves to be instrumental in improving nutritional adequacy while assisting in the management of body weight (2-3, 5).

Some researchers have suggested that consuming a high-protein breakfast can lead to a decrease in appetite, and therefore, a decrease in daily energy intake (24-26). However, current research does not fully support this hypothesis. In a study performed by Leidy et al (24), participants who consumed more protein during breakfast reported a greater feeling of satiety; however, this experiment did not examine actual energy consumption (24). Another study examining the effects of different types of protein consumed also demonstrated that increased protein consumption did not affect daily total energy intake, although quality and type of protein did positively impact satiety (25). In a different study conducted by Leidy (26), breakfast consumption of protein-rich foods led to decreased energy consumption during lunchtime as compared to protein-normal breakfast consumption (372 kcal vs. 503 kcal,  $p < 0.05$ ). However, no difference was noted in total daily energy consumption between the two groups (2502 kcal vs. 2530 kcal,  $p > 0.05$ ) (26). Therefore, high-protein breakfasts may decrease satiety, but they may not lead to an overall decrease in total daily energy intake.

Other researchers have examined fat intake during breakfast and its role in BMI and total daily energy intake (5, 27). As previously mentioned, breakfasts consisting of meat and eggs have a higher fat content, and those who consume these breakfasts have a higher total daily energy intake (5). In a study examining macronutrient consumption during breakfast and subsequent food intake, researchers discovered that high fat breakfasts are associated with delayed gastric emptying and increased satiety (28). However, the participants who consumed high fat breakfasts in this study had higher total energy intakes when compared to those who consumed low fat breakfasts (3886 kcal vs. 3583 kcal, respectively). These results suggest that the macronutrient composition of breakfast may have an effect on total energy intakes and subsequent meal intakes.

#### *The effect of location on breakfast consumption*

Where people choose to eat breakfast also plays a role in daily energy intake. Most young adults eat at home (75%), while 10% eat at fast-food restaurants and 15% eat elsewhere (6). In younger children, school breakfasts have had a positive effect on breakfast consumption. Children who eat breakfast at school have fewer nutritional deficiencies than those who do not eat breakfast or those who eat at home (8). Eating breakfast at school may be better for children because many consume a higher fat breakfast at home than they do at school (34% vs. 23%) (8). Children who do not eat breakfast at school or at home typically purchase more unhealthy snacks later on during the day (15). School breakfasts have succeeded in correcting many nutritional deficiencies, but still there is room for improvement (8). School systems should promote school breakfasts more strongly and nutritional contents of these breakfasts need to be optimized.

Many school-aged children, especially adolescents, do not take full advantage of breakfast programs at school because of negative weight perceptions and skewed beliefs concerning breakfast consumption (7). These issues will be further discussed in the following section.

### *Popular beliefs about breakfast*

One of the major reasons breakfast consumption has been on a decline may be that many people are uneducated about the benefits of breakfast consumption. The most popular reasons why many children and adolescents skip breakfast are limited nutritional knowledge, lack of time to make breakfast, or concern about their weight (4). For instance, people often attempt to control their body weight by limiting food intake, skipping meals, and fasting (7). Fasting in order to reduce weight is associated with not consuming breakfast (7). Teenagers often try to control their weight because of negative perceptions about their body weight. Consequently, teenagers often skip breakfast because they believe that doing so will decrease their caloric intake and ultimately help them to control their weight (7). Girls concerned with body image are more likely to skip breakfast than girls who are not concerned about body image (7).

### *Breakfast consumption in young adults*

The breakfast consumption habits of young adults differ from those of adolescents and older adults (16). Adults younger than 30 years of age are less likely to consume breakfast than adults older than 65 (45% vs. 86% consume breakfast, respectively) (1). Data from the National Longitudinal Study of Adolescent Health (16) show that people consume breakfast less often during their adult years as opposed to their adolescent years.

In general, participants reported eating breakfast four to five days a week during adolescence, but only 3 times a week for adults aged 18 to 27 (16). The effects of breakfast consumption and nutrient status among young adults aged 19 to 28 were examined in a study conducted using data from the Bogalusa Heart Study (6). Their results demonstrate that young adults who skipped breakfast had lower daily intakes of energy, protein, and saturated fat. Additionally, a higher percentage of breakfast skippers failed to consume two-thirds of their Daily Recommended Allowance of vitamins and minerals (6). The breakfast patterns of young adults are unstable largely because they have more autonomy of their lives, especially their own finances. Therefore, they have the option to consume more fast food or eat out at restaurants (15, 16).

#### *Breakfast consumption and the future*

It is imperative to establish proper food consumption patterns early in life. Eating patterns established in childhood persist into adulthood (8). Children who do not regularly consume breakfast are also less likely to consume lunch or dinner regularly (15). Children who do not typically eat breakfast are also more likely to snack on unhealthy foods (15). As young adults turn into parents, they need to establish good eating habits themselves in order to properly educate their children about diet and nutrition. Although breakfast consumption has been shown to increase with age, it is still important to learn proper eating habits early on to increase quality of life across generations (10).

In conclusion, breakfast consumption has decreased significantly over the past thirty years, potentially contributing to the obesity epidemic. While considerable research has been performed on the breakfast consumption habits and implications among children,

adolescents, and adults, there has not been enough focus on the breakfast eating habits of young adults. More research needs to be conducted for this sensitive population. Data should be collected concerning the effects of breakfast type on nutritional status and disease risk for young adults. Clinical trials should be conducted on how to properly educate young adults about making their own diet choices. As young adults age and mature, their potentially poor breakfast habits could have serious implications in the future. Misguided beliefs about breakfast consumption should be addressed, and proper eating habits should be instilled in the American population.

## Chapter 3: Methods

### Parent Study Overview

The current study used data collected from the Jayhawk Observed Eating Trial conducted at the University of Kansas. Details of the study and the results of the main outcome have been previously published (28). The primary purpose of the randomized efficacy trial was to determine the effects of three different levels of fat intake on body weight and body composition in college students. The secondary aim of the study sought to determine if consumption of diets containing 35% or more fat indicated a higher total energy intake versus lower fat diets. Participants (n=305) were randomized into three groups, with each group assigned a level of fat intake to adhere to during a 3-month period. These levels included low (25% fat or less), moderate (28-32% fat), or high (35% fat or more) fat. Study participants were required to consume two meals per day on weekdays and one meal per day on weekends at the university cafeteria. Digital photography and dietary recalls were used to track the food consumption of the participants. Research staff took photographs of the food items selected by the participants at each meal before and after consumption. The composition of the foods was determined through the Nutrition Data System for Research (NDSR) version 2005 (exported using NDSR version 2010).

### Sample

Study participants were recruited from the student population of the University of Kansas. Freshmen were the primary target of the study. Three strategies were used to recruit students. First, an informational sheet was mailed to students in the freshman orientation package. Those students who did not respond to this preliminary mailing were

recruited during summer orientation via seminars. Additional recruitment sessions took place during Hawk Week in the form of informational sessions and table tents in dining halls.

Inclusion criteria included:

1. 17 years of age or older (if less than 18 years of age, parents required to sign informed consent form as well as the participant)
2. BMI of 22-29.9 kg/m<sup>2</sup>
3. Weight stable ( $\pm$  2.27 kg) for a period of 12 weeks before baseline exam
4. Good health
5. Non-smoking
6. Lack of cardiovascular disease, hypertension, or metabolic disorders
7. Consumption of less than three alcoholic beverages per day
8. Sedentary lifestyle (<500 kcal/week of exercise expenditure)
9. Absence of clinical depression as measured by the CED-D Scale (29)
10. Absence of eating disorders as measured by the eating attitudes test (30)
11. Habitual fat intake between 20-50% of total energy intake as measured by the NIH Fat Screener (31)
12. Not on a special diet



### Exclusion criteria included:

1. Subjects who demonstrated contraindications based on the physical examination.  
The examination included medical history, blood pressure, lipid profile, glucose and insulin, and use of medications.
2. Cardiovascular disease and metabolic disorders (dyslipidemia, hypertension, diabetes)
3. Medications that could interfere with metabolism (cardiac drugs, steroids, etc)
4. Use of tobacco products
5. Alcohol consumption of more than 3 drinks/day or a total of 18 drinks/week
6. Evidence of eating disorder (30)
7. Adherence to a specialized diet
8. Treatment for psychiatric illness (29)

### Setting

All study participants reported to the University of Kansas for the duration of the study. Meals were consumed over the 12-week period in the Ekdahl Dining Commons at the University of Kansas cafeteria or at Oliver Hall dining center. Anthropometric data were measured in the KU Energy Balance Laboratory at baseline, 6, and 12 weeks.

### Ethics

This study was approved by the Human Subjects Committee at the University of Kansas (protocol #12195). All subjects signed an informed consent prior to participation in any study related activities. Subjects were compensated for their participation in the study.

## Data collection

### *Descriptive Data*

A questionnaire was administered to collect socio-demographic data necessary to characterize the sample population (i.e., age, gender, ethnicity, etc).

### *Anthropometric Data*

Body weights were measured following a 12-hour fast at baseline, 6 and 12 weeks between the hours of 6 a.m. and 10 a.m. The participants wore a hospital gown and were weighed on a digital calibrated scale (Model #PS6600). Height was measured with a stadiometer.

### *Dietary Intake Data*

Subjects were required to eat at the Ekdahl Dining Commons at the University of Kansas cafeteria or at Oliver Dining Hall. Dietary intakes were measured continuously from baseline until the completion of the study by using both picture plate waste (PPW) and dietary recalls. PPW was completed for a minimum of two meals a day on weekdays or one meal a day on weekends. Intake from other meals and snacks were captured via dietary recalls. At baseline, PPW studies were conducted on four days (3 weekdays and 1 weekend day) in order to determine average energy and fat intake. During the intervention, at least four random days were documented each week in which nutrient analysis was performed on dietary data obtained by PPW and recall (for the total 24 hour period). NDS-R was used to calculate energy and macronutrient content of diets.

Picture Plate Waste: Dietary intake for the cafeteria meals was assessed using digital photography. This procedure involved obtaining standardized photographs of each meal. Two before and after pictures were taken at each meal to ensure proper depth perception (taken at 45 and 90 degree angles) to maximize identification of foods. The date, meal name (e.g. breakfast), participant identification number, and food descriptions were recorded for each of the participants' meals onto a small card, which was then photographed with the food tray. Pre and post pictures of the meal were viewed simultaneously by the research staff in order to determine intake. Pre-coded data sheets were used to mark the meal and portion size consumed of each food item.

Dietary Recalls: Dietary recalls were used to record food consumed outside of the university cafeteria. These were standardized, multiple-pass recalls. Subjects were given 2-dimensional food models to aid in accurately reporting portion sizes.

### *Staff Training*

Dietary intake staff received nine hours of training from a supervising dietitian. They were taught procedures for dietary recalls, obtaining PPW, PPW visual estimation, and NDS-R coding. All dietary staff was required to show a standard of 90% accuracy with each technique in order to be certified. Accuracy was determined through comparison of results to the supervising registered dietitian, NDS-R coding, and measured food items for PPW. Training occurred over a seven-day period and reliability procedures were repeated at six weeks.

## Data Analysis

Dr. Jaehoon Lee, the statistician at the University of Kansas Energy Balance Lab, performed the statistical analyses for this study. In order to determine the descriptive statistics for participant characteristics, means and standard deviations were calculated for continuous variables and frequencies and percentages were calculated for categorical variables. Gender differences in BMI and percent breakfast composition were assessed using independent-samples *t*- tests. Two consumption variables were derived for each participant. Percent breakfast consumption was determined for each participant by dividing total days of breakfast consumption with total days of meals recorded. Therefore, higher percent values indicated more frequent breakfast consumption. The percent cereal consumption at breakfast was calculated as percentage of total days of cereal consumption at breakfast over total days of breakfast consumption. Thus, higher percent values indicated more frequent cereal consumptions at breakfast. Both baseline data and data during the intervention phase of the parent study were used to determine these percentages.

For the first and third research questions, the association between BMI and percent breakfast consumption and cereal consumption was determined using general linear modeling (i.e., regression). The gender of the participants was used as a covariate in the regression model. Percent breakfast consumption and cereal consumption were determined using data obtained throughout the study. The BMIs used were obtained from baseline data.

For the second research question, mixed modeling (i.e., multilevel regression) was used to determine the effect of macronutrient consumption (percent calories from fat,

carbohydrate and protein) at breakfast on total daily energy intakes. Baseline data were used to determine these percentages. Interdependency among observations was accounted for in these tests. Macronutrient consumption was recorded daily (level-1) within each participant (level-2). In this case, mixed modeling provides a reasonable control for Type I error (32) and offers various options for specifying the covariance structure of the repeated observations. Compared to unstructured, first-order autoregressive, or variance compound structures, compound symmetry structure yielded smaller Akaike Information Criterion and Bayesian Information Criterion values; therefore, compound symmetry structure was chosen for the covariance structure. Participants' gender was used as a level-2 covariate to account for any gender differences in the sample, thus increasing the power to identify significant macronutrient consumption effects in the mixed model. Statistical significance was determined at a 0.05 alpha level. All analyses were conducted using SAS 9.2. (33).

## Chapter 4: Results

The objective of this study was to determine the association between breakfast consumption and BMI among young adults. The secondary objectives of the study were to investigate the relationship between macronutrient consumption and daily energy intake, and the relationship between ready-to-eat cereal consumption and BMI in young adults.

### Subject Characteristics

Complete data were available for 267 participants, 99 females and 168 males. A summary of the baseline characteristics can be found in **Table I**. Female participants had significantly lower BMIs than male participants,  $t(265) = -2.87, p < 0.01$ . Of the 267 participants, 257 participants consumed breakfast at least once during the course of the entire study. Female participants consumed breakfast more frequently than male participants,  $t(265) = 4.22, p < 0.01$ . Sixty-two participants consumed cereal at least once during the course of the study. There was no statistically significant difference in the frequency of cereal consumption at breakfast between male and female participants,  $t(255) = 0.15, p = 0.88$ .

Table 1. Summary of Baseline Characteristics and Breakfast Consumption Patterns

Variable	Male			Female			Total		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Weight	168	79.37	9.73	168	79.37	9.73	267	74.44	11.22
Height	168	178.46	6.57	168	178.46	6.57	267	173.79	8.88
BMI	168	24.90	2.52	168	24.90	2.52	267	24.56	2.53
<i>Consumed Breakfast</i>	160	24.83	2.53	160	24.83	2.53	257	24.51	2.54
<i>Did not consume breakfast</i>	8	26.15	2.11	8	26.15	2.11	10	25.91	1.96
<i>Consumed cereal at breakfast</i>	44	25.06	2.47	44	25.06	2.47	62	24.52	2.45
<i>Consumed something else at breakfast</i>	116	24.75	2.56	116	24.75	2.56	195	24.50	2.57

### Breakfast Consumption and BMI

Participants were excluded from the study if insufficient data were present to accurately determine their percent breakfast consumption (n=5). Therefore, the sample size used to assess the association between breakfast consumption and BMI status was 262. Breakfast consumption was determined by using data presented throughout the course of the entire parent study as opposed to baseline data alone, since not enough days of baseline data were recorded to accurately determine breakfast consumption patterns. Percent breakfast consumption was calculated by taking the total days of breakfast consumption over the total days of any meal records made throughout the trial. After controlling for gender, breakfast consumption was significantly associated with BMI. For instance, an increase of 2-3 (28.6-42.9%) days per week of breakfast consumption would yield a decrease of 0.42-0.64 kg/m<sup>2</sup> in BMI. Consuming breakfast everyday (100%) would yield a decrease of 1.49 kg/m<sup>2</sup> in BMI. The results of the general linear modeling are provided in **Table 2**.

Table 2. General Linear Modeling Results (N=262) for Breakfast Consumption and BMI

Effect	<i>Estimate</i>	<i>SE</i>	<i>p</i>
Intercept	25.44	0.28	0.00
Gender			
<i>Female</i>	-0.70	0.32	0.03
<i>Male (reference)</i>	-	-	-
% breakfast consumption	-0.0149*	0.01	0.01

\*Significant at p=0.01

## Macronutrient Consumption and Daily Energy Consumption

Participants were excluded for this research question if they did not consume breakfast. This yielded a sample size of 222. **Table 3** illustrates the percent fat, protein, and carbohydrate consumed at breakfast along with the total calorie intake during breakfast. Fat consumption during breakfast significantly predicted total daily energy intake after adjusting for participants' gender. For example, a 1% increase in fat calories consumed during breakfast would yield a 9.17 kilocalorie increase in total daily energy consumption. However, neither the percent calories from carbohydrate or percent calories from protein during breakfast significantly predicted total daily energy intake. The mixed modeling results can be found in **Table 4**.

Table 3. Percent Macronutrient Consumption during Breakfast and Total Daily Calorie Intake

Variable	<i>N</i>	<i>M</i>	<i>SD</i>
Total daily calories	223	2612.01	770.15
% fat calories at breakfast	222	27.56	12.28
% carbohydrate calories at breakfast	222	59.49	14.87
% protein calories at breakfast	222	12.43	6.03

Table 4. Mixed Modeling Results (*N* = 222) for Macronutrient Consumption and Daily Energy Intake

Effect	Estimate	SE	p
Intercept	2730.08	387.87	0.00
Gender			
Female	-789.81	86.68	0.00
Male (reference)	-	-	-
% fat calories	9.17*	4.29	0.03
% carbohydrate calories	1.78	3.95	0.65

\*Significant at  $p=0.03$



### Ready-to-Eat Cereal Consumption at Breakfast and BMI

Only participants who consumed breakfast at least once during the course of the parent study were included in this research question, yielding a sample size of 257. **Table 5** shows baseline data concerning breakfast consumption patterns of the participants. Of the 257 participants that consumed breakfast, 62 consumed cereal at breakfast while 195 consumed something else at breakfast. After controlling for gender, ready-to-eat cereal consumption at breakfast was not significantly associated with BMI. The general linear modeling results are provided in **Table 6**. These values were determined using data collected throughout the entire parent study as opposed to baseline data alone. Percent cereal consumption at breakfast was calculated by taking total days of cereal consumption at breakfast over total days of breakfast consumption. The average BMI for the 62 cereal consumers at breakfast was 24.52 kg/m<sup>2</sup>, whereas the average BMI for the 195 non-cereal breakfast consumers was 24.50 kg/m<sup>2</sup> (p=0.62).

Table 5. Baseline Characteristics for Cereal Consumption during Breakfast

Variable	Total		
	N	Mean	SD
BMI	267	24.56	2.53
<i>Consumed breakfast</i>	257	24.51	2.54
<i>Did not Consume breakfast</i>	10	25.91	1.96
<i>Consumed cereal at breakfast</i>	62	24.52	2.45
<i>Consumed something else at breakfast</i>	195	24.50	2.57

Table 6. General Linear Modeling Results ( $N = 257$ ) for Ready-to-Eat Cereal Consumption and BMI

Effect	<i>Estimate</i>	<i>SE</i>	<i>p</i>
Intercept	24.92	0.27	0.00
Gender			
<i>Female</i>	-0.86	0.32	0.01
<i>Male (reference)</i>	-	-	-
% cereal consumed at breakfast	-0.00236	0.00470	0.62

## Chapter 5: Discussion

The results of this study may broaden current knowledge about breakfast consumption and its effects on the young adult population. While attending college, many young adults are faced with the task of choosing all of their own meals for the first time in their lives. This study can demonstrate the importance of not only consuming breakfast, but also pinpoint the more healthful choices to make during this meal. Additionally, the relationship between breakfast consumption and BMI and the relationship between fat consumption during breakfast and total energy intake for young adults are explored in this study. Due to the weight gain many young adults experience during their college years, these associations should be of particular concern. In order to decrease the incidence of future obesity, weight gain during the college years should be prevented and healthful lifestyle choices adopted. When these young adults start their own families, they must possess the proper eating habits to pass onto the next generation.

### Breakfast Consumption and BMI

Numerous studies have demonstrated that increased breakfast consumption is associated with decreased BMI among various age groups (4, 5, 10). The current research findings replicate these results with respect to the young adult population. Eating breakfast every day would yield a 1.49 kg/m<sup>2</sup> decrease in BMI.

Many other factors may have contributed to this phenomenon. For instance, breakfast consumers might make healthier lifestyle choices than breakfast skippers, like exercising more or observing better eating patterns. Another potential confounding factor is the BMI exclusion criteria. Participants were only allowed to participate in the current

study if they had a BMI between 22.0-29.9 kg/m<sup>2</sup>. This excludes both underweight and obese individuals, which affects the generalizability of the results. Underweight and obese individuals may have different breakfast consumption patterns, which would be reflected in their BMIs. Lastly, the protocol requirements of the parent study could have affected the meal patterns of the participants. Participants needed to consume two meals per day at the aforementioned dining halls. Typical breakfast skippers could have added breakfast to their usual meals in order to eat elsewhere during dinner.

### Macronutrient Consumption and Daily Energy Consumption

Studies have also shown that people who consume breakfasts that are high in fat typically have greater total daily energy consumption (3, 4). The results of the current study demonstrate this phenomenon. A 1% increase in fat calories consumed corresponded with a 9.17 kcal increase in total daily energy intake. Fat intake during breakfast correlates with higher total daily energy intake. Some of this increased energy intake can be attributed to increased energy intake during breakfast due to fat. Conversely, protein intake during breakfast does not impact total daily energy intake, which confirms results from other studies (24, 25, 26). These studies also suggest that higher intake of fat or protein during breakfast increases subsequent feelings of satiety (24, 25, 26), which the current study does not examine. Carbohydrate intake during breakfast also does not impact total daily energy consumption. However, diets higher in carbohydrate and lower in fat have been shown to correlate with weight loss (3). Therefore, further investigation of the role of carbohydrate intake is needed.

## Ready-to-Eat Cereal Consumption and Breakfast and BMI

Many studies investigating ready-to-eat cereal have shown that increased consumption of ready-to-eat cereal at breakfast was associated with a decreased BMI (3-4). The current study failed to replicate these results. Many factors may have led to these conflicting findings. Since only baseline data were used to measure macronutrient intake, breakfast patterns of the participants may not have been accurately captured because only a few days of data were collected. Thus, the data collected may not have been representative of the participants' actual breakfast consumption habits. Also, ready-to-eat cereal consumption was not limited to breakfast alone, even though the results of this study were based off of cereal consumption during the breakfast meal. Participants may have snacked on cereal later on during the day or even replaced a later meal with cereal, thereby affecting the potential influence of cereal consumption on BMI. Additionally, individuals were excluded from the study if their BMIs were lower than 22 kg/m<sup>2</sup> or greater than 30 kg/m<sup>2</sup>. People with lower BMIs could have made up a large number of ready-to-eat cereal consumers while people with higher BMIs may have consumed less ready-to-eat cereal during breakfast. Research has demonstrated that those who consume cereals for breakfast typically have lower BMIs than those who do not (3, 4). Therefore, ready-to-eat cereal consumption may have had a greater impact on BMI than this study suggests.

## Limitations

This study has several limitations that must be taken into consideration when interpreting the findings. The generalizability of this study was limited since study

participants had a similar education level. Previous studies have demonstrated that education level does impact breakfast consumption patterns (34). Higher education levels are indicative of increased frequencies of breakfast consumption (34). Also, the sample population was not ethnically representative of the United States, since the sample population was 85% Caucasian (28).

Likely the largest limitation of the current research is that the study was part of a larger trial in which a specific level of fat intake was prescribed for each participant, which could impact the meal consumption patterns of participants as well as their daily total energy intake. However, only the research question concerning macronutrient consumption focused on baseline data, so that portion of this study would not be affected by the larger trial. Participants were also required to eat at the dining halls on campus, which may have affected their food choices as well as their meal choices. The food items students were given to choose from may not have reflected their choices outside of the cafeterias. Also, participants were required to eat two meals per day during the week and one meal per day during the weekend at a specified cafeteria. Participants could have chosen to eat more meals than they normally would in order to fulfill these requirements. Additionally, diet recalls were collected from participants in order to record foods eaten outside of the cafeterias. Participants may have misreported the foods they consumed. A major strength of this study was the use of PPW in measuring dietary consumption. PPW provided a means to more accurately record food consumption than the traditional diet recalls because portions consumed were made visible through before and after pictures for each meal. These measures strengthened the accuracy of the food quantities documented.

Furthermore, much of the data used were obtained during baseline data collection, which affected the question concerning macronutrient consumption during breakfast. Baseline measurements only examined a minimum of four days of food consumption, which may not have accurately captured the participants' typical breakfast consumption patterns. Ready-to-eat cereal consumption was not limited to breakfast alone. Cereal consumption during other meals may have had an impact on BMI and dietary intake, thereby potentially skewing the results of the third research question. Lastly, the parent study targeted college freshman, many of whom had to feed themselves for the first time. Most of the freshmen that purchased meal plans were living in the dormitories. Some students were selected during different semesters, so they might have had time to establish eating patterns while others have not. For example, students who participated in the spring semester may have had more established eating habits than those who participated in the fall semester.

### Implications and Future Studies

The current study sheds light on the relationship between breakfast consumption and BMI for young adults. Young adults that consume breakfast, especially breakfasts lower in fat intake, typically have lower BMIs. However, further research is still needed. Inclusion criteria need to be expanded to cover students of all BMIs. Future studies should examine the relationship between macronutrient content of breakfast and further snacking later on during the day. The effects of macronutrient content of breakfast on satiety in young adults should also be determined. Studies should compare breakfast patterns of college students who gained weight during their freshman year to college students who did

not gain weight during their freshman year. Also, future studies should look at the differences in breakfast consumption patterns before college and during college to see if a difference exists between consumption trends during these two time periods. Longitudinal studies could be conducted to track breakfast patterns of students throughout college and into later life.

### Conclusion

For young adults, increased breakfast consumption correlated with decreased BMI. Fat consumption during breakfast predicted total daily energy intake. Additionally, there appears to be an inverse correlation between protein consumed during breakfast and total energy intake, but these results were not significant. However, carbohydrate consumption during breakfast did not predict daily total energy intake. Increased cereal consumption at breakfast was not associated with decreased BMI in this sample. These findings indicate that breakfast consumption and the macronutrient content of breakfast have an impact on BMI and total daily energy consumption. Therefore, young adults should make breakfast a part of their daily routines. When selecting their breakfasts, young adults should also consider the macronutrient content of their foods and choose those with a lower fat content in order to reduce total daily energy intake and prevent future weight gain.



## Chapter 6: Summary

The purpose of this study was to a) determine the relationship between BMI and breakfast intake in young adults, b) determine the effects of macronutrient consumption on total daily energy intake and to c) determine the relationship between ready-to-eat cereal consumption during breakfast and BMI. The data used were collected from the parent study (28). The sample consisted of 267 participants recruited from the University of Kansas. Among these individuals, ninety-nine were female and one-hundred and sixty-eight were male. Individuals were observed over a 12-week period. Participants were required to eat a prescribed number of meals at university dining halls and dietary intakes were recorded using PPW and dietary recalls.

A significant relationship was observed between increased breakfast consumption and decreased BMI. An increase of 2-3 (28.6-42.9%) days of breakfast consumption would yield a decrease of 0.42-0.64 kg/m<sup>2</sup> in BMI. Fat consumption during breakfast significantly predicted total daily energy intake. If fat calories were increased by 1%, total energy consumption would increase by 9.17 kcal. However, carbohydrate and protein consumption did not significantly predict total daily energy intake. Cereal consumption at breakfast was not found to be significantly associated with BMI.

Many limitations could have impacted the results of this study. The current study was part of a larger study, which restricted dietary choices; participants were selected based on BMI; and baseline data were limited to only four days of intake. Future studies should expand the BMI range of participants and no restrictions should be placed on their dietary choices.

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**Appendix A**  
**Consent Forms**

**CONSENT FOR RESEARCH:**

HSC-L Protocol Number: 12195

**TITLE OF THE RESEARCH STUDY:**

Effects of diet on immune function.

**INVITATION TO PARTICIPATE:**

You are invited to participate in this research study, which involves assessment of diet intake for 3 months.

**BASIS FOR SUBJECT SELECTION:**

You are eligible to participate in this study if you meet certain criteria. You are a KU student and you have a body mass index between 21 and 30 (an index of height and weight), you have a 13 or 19 meal plan and reside in the KU dormitories, you do not have a regular exercise program, are willing to eat an average of 2 meals per day during the week and 1 meal per day on the weekend in Ekdahl Dining Commons or Oliver Dining Hall, and are willing to be randomized to 1 of the 3 diets described below. You are willing to provide periodic additional commitments for physiological testing and diet interviews, energy balance and substrate oxidation studies, etc. as described later in this document. You do not currently nor do you intend to have during this study an overloaded academic, employment, social, and/or extracurricular activities schedule that would interfere with your ability to be compliant throughout this research project. You appear to be healthy and show no contraindications for this study based on a modified physical examination. This physical examination includes a medical review of your health history, resting blood pressure and heart rate, body composition, blood chemistry, and lipid profile. You do not have cardiovascular disease or metabolic disorders (e.g. diabetes, thyroid, etc.). You are not taking medications, which could affect metabolism or diet intake such as cardiac drugs, thyroid, antidepressants, etc. You are not pregnant nor do you intend to become pregnant. Pregnancy at any time will result in immediate termination should you become a participant. You are not currently attempting to alter your weight (i.e., energy restriction, protein supplementation, weight loss drugs, etc.). You do not perform exercise to a level, which exceeds 500 kcal per week as determined by a physical activity questionnaire. You are able to perform physical fitness, body composition or metabolic tests in the Energy Balance Laboratory as described below.

**PURPOSE OF THE STUDY:**

The aim of this study is to determine if the composition of your food intake affects your immune function.



## **EXPLANATION OF PROCEDURES:**

Diet Groups. You will be placed in 1 of 3 diet groups. The diets are not dramatically different and consist of foods available at the Ekhdal Dining Commons (Mrs. E's). The diets differ in macronutrients (i.e. carbohydrate, fat, and protein) and micronutrients (i.e. fiber, vitamins, and minerals). You will be assigned to a group randomly and must be willing to follow the diet for 3 months (September – December or January - May).

Nutrition Education. You will receive nutrition education provided by a registered dietitian or a research assistant. Education sessions will occur periodically for 3 months. You will be divided into small groups of 10-15 persons for dietary education. Written booklets and daily menus listing food items in the nutritional profile assigned to you will be provided. Additional nutritional education will be provided as needed in assisting subject's choosing appropriate foods to meet their dietary profile.

Dining Facility. Throughout the entire study, you will be required to eat 2 meals per day on weekdays and 1 meal per day on the weekend at the Ekhdal Dining Commons (Mrs. E's) at the University of Kansas with the exception of periods of University recesses or investigator approved absences, to be discussed later in this document. The cafeterias feature a variety of entrees including stir-fry, pasta, salads, sandwiches, a pizzeria and a grill. Students may typically choose from 8-10 entrees at each meal. The Energy Balance Laboratory has secured the rights to one section of the cafeteria for all dietary testing. You will be required to bring your food tray for each meal to the research area for measurements of all food items. Non-research students will be able to accompany and dine with you. Thus, the normal social aspects of the meal will be preserved.

Picture Plate Waste (Digital Photography). Picture plate waste (digital photography) will occur every day throughout the semester to determine your current dietary habits, patterns, and intake. Picture plate waste will be used to determine if you are choosing appropriate foods to meet your dietary profile. Every day, you will go through the cafeteria, select your food choices, and bring your tray to the research site. You will slide your cafeteria tray under a mounted digital camera before and after meal consumption. Taking a picture of the foods should take no more than a few minutes and may be done while you are interviewed regarding food clarification (Ex. Regular Coca-Cola vs. Diet Coke). You will then consume your meal. When you have completed your meal, you will give your tray to research staff for another photograph of your plate waste. Uneaten portions of food and caloric beverages will be estimated and recorded by research staff. You will be free to consume additional food items, but will be required to follow the same procedures for recording and photographing the food items. To document foods and beverages consumed outside of the cafeteria (snacks) during the picture plate waste studies, brief food recalls will be conducted.

Diet Recalls. Your total dietary energy (calories) and macronutrient consumption (carbohydrate, fat, and protein) will be measured outside the cafeteria as well. The calories and composition of the food eaten outside of the cafeteria will be calculated from records of food consumed through food recalls. As part of this record of food intake, you will be

instructed in remembering brand name, portion size, and method of preparation and ingredients. You may also be encouraged to bring in labels or packages of any foods consumed to help in the accurate collection of this data.

Weighed Plate Waste (Calorimeter Subjects Only). Weighed plate waste will be performed on each of the calorimeter subjects at the beginning and at the end of the research study for 3 consecutive days prior to entering the calorimeter. For all weighed plate waste days, the research staff will go through the cafeteria, select your food choices, and bring your tray to the research site. Research staff will weigh items and record foods/beverages weights on data sheets. The total number of calories consumed during this time will be based upon a resting metabolic rate test. You will then consume your meal at tables within the designated area monitored by research staff. When you have completed your meal, you will give the tray to research staff.

Snacks. You will receive specific snacks that meet the targeted diet profile. The research staff will deliver the snacks weekly to participants. You will have to select snacks consistent with your appropriate food profile. Snacks include a variety of pre-packaged food items.

Questionnaires. You will complete behavioral, physical activity, immune function, and health history questionnaires at baseline and at the end of the study and these questionnaires will take about 45 minutes to answer.

Behavioral questionnaires. Behavioral questionnaires will be used to measure your habitual eating behaviors. These questionnaires ask questions to allow the researchers to better understand your current dietary habits.

Physical Activity Questionnaires (PAQ). You will be asked to complete a computer based physical activity questionnaire. This questionnaire assesses normal physical activity. You will be asked about the number of minutes you engage in activities requiring a variety of levels of physical activity. Numerous practical examples are given to help you answer the questions accurately. This test takes only 15 minutes to complete. This test will occur 3 times during the study at baseline, mid-point, and at the end.

Immune Function Questionnaire. Weekly (every Monday) you will be required to complete an immune function questionnaire. This questionnaire will be utilized to assess the effects of the current dietary profile on immune function. You will be required to list any prescribed and/or over the counter medications, reason for taking, and the dosage. You will need to write down the exact name of the drug or bring in the prescription. You will also record any feelings of sickness (runny nose, upset stomach, headache, etc.) and the number of visits to the health clinic or physician. The questionnaire will be administered online via the internet and should take 5 minutes to complete.

Health History. A brief health history questionnaire will be used to assess your current health status. This questionnaire is aimed at identifying individuals who may be contraindicated to being a participant in this study. This health history is completed only at baseline and should take 10 minutes to answer.

**Body Fluid Samples. You will be asked to obtain a small amount of blood (about 5 teaspoons) from a vein in your arm for analysis of lipids, glucose and insulin following a 12 hour fast. Furthermore, we will store a sample of blood for possible genetic testing to discover why there are differences among individuals that may help explain the results of the study.** Females will have a separate urine test for pregnancy prior to body composition analysis as described below.

Resting Blood Pressure. Blood pressure will be measured at baseline, mid-point, and at the end of the study. Blood pressure will be measured using a standard blood pressure cuff and stethoscope. Measurement will begin after 5 minutes of quiet rest in the supine position. Two measures will be obtained and additional measures will be performed if the measures differ by more than 5 mmHG.

Resting Heart Rate. Heart rate will be measure at baseline, mid-point, and at the end of the study. Measurement will begin after 5 minutes of quiet rest in the supine position. Two measures will be obtained and additional measures will be performed if the measures differ by more than 5 beats per minute.

Body Composition/Regional Adiposity. Your body composition (fat and muscle) will be estimated by dual-energy x-ray absorptiometry (DEXA), skinfold thickness, and circumferences. A.) DEXA uses x-rays at extremely low doses to provide a 3 dimensional picture of soft tissue and bones. The radiation exposure is about equal to the radiation exposure from an airline flight from Chicago to New York or less than 1/30<sup>th</sup> of a chest x-ray. You will be asked to lie supine for about 30 minutes while a scan is taken. There is no sensation of discomfort with this procedure. B.) The technician will also measure folds of skin and circumferences on various locations at your back, arms, legs, and stomach. This test will occur 2 times during the study and takes about 45 minutes.

Resting Metabolic Rate. Your resting metabolic rate will be measured. You will be asked to abstain from eating 12 hours before this measurement. You will be asked to report to the Energy Balance Laboratory between 6:30 a.m. and 9:30 a.m. You will rest for 30 minutes, and then a ventilated hood will be worn for 30 minutes in which there is a constant flow of fresh air. A ventilated hood is a clear plastic hood, which covers your head and shoulders. Collection of exhaled air is then used to estimate the number of calories burned in one day. This test will occur 4 times (twice at baseline and twice at end) during the study and takes about 1 hour. Additional resting metabolic rate tests may be necessary for some subjects. A technician will inform you if you need to repeat this test.

Standardized Food. (Calorimeter Subjects ONLY). Subject's randomly selected for whole-room calorimetry will be required to eat a standardized diet for 3 consecutive days prior to entering the calorimeter and while they are in the calorimeter. Total daily caloric intake will be estimated and used to determine exact food amounts. The subject will be asked to provide information to the dietician regarding their food preferences. The subject will then meet with the dietician, who will provide the menu plan for the 3 days of standardized food taking into account subject dietary habits and schedule. Every meal will be planned and subjects will be expected to consume all food provided.

Whole-room Calorimetry Subjects ONLY. Subjects will be randomly selected from the entire participant population for whole-room calorimetry testing. Measurement of 24-hour energy expenditure will be performed in a room called a whole-room calorimeter. This room is 10 X 12 feet containing a couch that folds into a bed, a desk, a toilet, a telephone, and a computer with Internet access. The room is located within Robinson Center. You will spend 23 hours inside this room and will be asked to perform your normal daily activities (for example, you will not be allowed to sleep all day while in the room). An air lock allows food to be passed to you while you are inside the room. Fresh air is drawn through the room and the calories you use are calculated from the oxygen and carbon dioxide, which exits the room. You will not be locked in the calorimetry room; however, premature exit will void the test. This test will occur 2 times (baseline and end) during the study.

Compliance. Throughout the entire 3 month study, you will be required to eat 2 meals per day on weekdays and 1 meal per day on the weekend at the cafeteria at the University of Kansas with the exception of periods of University recesses. You will be allowed to miss 10% of the number of days in the 3 month eating period and/or 10% of missed meals. (i.e., During a 90 day study you will be considered compliant if you miss no more than 9 days and/or no more than 16 meals). **No subject will be allowed to miss greater than 2 consecutive days throughout the study without prior approval from the principal investigator.** University scheduled recesses do **NOT** count toward the 10%. The excuse for the absence from the study protocol is neither considered excused nor unexcused. The investigators weigh any absence from participation the same. You should plan ahead and schedule in your missed days or meals not to exceed 10%. Failure to comply will result in your immediate removal from the study.

Each week a data analysis will be conducted on the data sheets collected at the cafeteria to determine if subjects are eating within their assigned dietary profile. Counseling sessions will be provided to any subject determined not to be eating within profile to assist in adjusting subject's eating habits to meet dietary profile. The investigators will terminate any subject from the study if they are out of profile for more than 3 weeks throughout the 3 month intake.

You will be expected to complete baseline, mid-point, and end study physiological testing, behavioral questionnaires, blood draws, etc. Failure to complete testing will result in removal from the study.

Written warnings will be issued to study participants when 5% of missed days or missed meals have been tallied to give participants notification of their compliance. Written warnings will be issued a second time when subjects have accumulated 8% of missed days or meals informing them of the danger of their removal from the study. Written notification will also be issued when a subject has not been in dietary profile for 2 weeks.

You may be terminated at any time at the discretion of the principal investigator. Your failure to comply will not result in any loss of benefits to which you are otherwise entitled; however, you will lose the financial compensation originally offered.

Long-term Follow-up. Participants who remain enrolled at the University of Kansas will provide contact information for long-term follow-up testing. Body weight and body composition by DEXA will be measured during April of each subsequent year, for a minimum of 3 years.

**POTENTIAL RISKS AND DISCOMFORTS:**

Dietary. Changes in weight are possible; some dissatisfaction with food choices is possible.

Blood samples. A small chance of infection exists. Bruising at the site of sampling is possible.

Whole-room indirect calorimetry. There are no known risks; however, some subjects may feel confined by the small 10X10 feet room. The room is **NOT** locked.

Body composition (DEXA X-ray and Laser Risks and Benefits). You are volunteering to participate in a study in which your body composition and/or bone mineral content will be assessed using Dual Energy X-Ray Absorptiometry, commonly referred to as DEXA. This research study involves a procedure that uses x-rays. The evaluation is being done not because you are sick. There may be no direct benefit to you. The information that will be gained from the x-ray procedure may, however, provide important research data.

The DEXA assessment will provide the investigators information regarding your body composition including fat weight and lean body weight (Ex. muscle weight), bone mineral content, and bone mineral density. This information is being used solely for description purposes and to assess the effect of various research protocols on these parameters. This information is not intended to be used as a clinical assessment of a medical condition. Participants will be evaluated at the beginning and at the end of the treatment period. Any finding of concern would be relayed to the participant, the study physician consultant, and the current participant's private physician.

The University of Kansas has adopted the philosophy of safety that all exposures to radiation, other hazardous materials, and risks from physical hazards shall be kept "as low

as reasonable achievable.” There are certain limitations placed upon this procedure to achieve that aim.

If you are pregnant you cannot participate in this study. If you become pregnant while taking part in this study, please inform the research director; you will not be able to continue the study. We also want to evaluate the amount of radiation that you have received in the past year, so if you have had other x-rays, let us know. If you have recently undergone CT (Computed Tomography), PET, fluoroscopic, or nuclear medicine studies within the past year, you cannot participate in this study.

The parts of your body that will receive the most radiation are the skin, although your whole body will be exposed to the radiation. The amount of radiation that you will receive from a whole body scan is equivalent to a uniform whole-body exposure of 0.1 mrem. Exposures of the femur and/or spine are equivalent to exposures of 2.4 to 4.8 mrem per scan. The typical radiation exposure from a normal chest x-ray is 30 mrem. Although you will be receiving a small amount of exposure, the risk from radiation exposure of this magnitude is too small to be measured directly and is considered to be negligible when compared with other everyday risk. The Radiation Safety Officer at the University of Kansas can provide you with more information about radiation exposure if you are interested.

Trained personnel who have either received accreditation from the International Society for Clinical Densitometry for diagnostic procedures are making the DEXA measurements, or who have received formal training by the manufacturer following installation of the DEXA for femur/spine/total body scans.

The system is equipped with a Class II Laser device. A Class II rating indicates a low power visible laser that is nor normally hazardous to eyesight but has the potential to be hazardous if viewed directly for an extended period of time. Because of the potential hazard, **DO NOT** stare directly into the beam while the laser is in operation. The beam should not be pointed directly in the eye of the participant.

**POTENTIAL BENEFITS:**

Your participation in this study may help you understand more about nutrition and food choices. The tests in the Energy Balance Laboratory may help you understand more about your health status. Potential benefits for DEXA include knowledge regarding weight control, body fat, and health risk improvement. You will receive financial compensation for successful participation and completion.

**MEDICAL CONSULTANT:**

Mary Vernon, M.D., medical consultant to the program, and will provide a medical review of health history and a modified physical examination for those subjects who voluntarily participate in the research program.

**ALTERNATIVES TO PARTICIPATION:**

The alternative to your participation in this research study would be not to participate.

**FINANCIAL OBLIGATIONS/COMPENSATION FOR PARTICIPATION:**

For your participation you will receive compensation, which totals \$1250.00 at the end of the 3 month period upon the completion of the study. This compensation will be paid based on your completion of the project, your successful participation, and your willingness to perform as a research subject. Researchers may ask for your social security number in accordance with federal and state accounting regulations

**EMERGENCY MEDICAL TREATMENT:**

In the event of a research related injury or an adverse reaction, please immediately contact Dr. Joseph E. Donnelly (785) 864-0797, or Dr. Bryan K. Smith at (785) 864-0776.

**KANSAS TORT CLAIMS ACT:**

In the event of injury, the Kansas Tort Claims Act provides for compensation if it can be demonstrate that the injury was caused by the negligent or wrongful act or omission of a state employee acting within the scope of his/her employment.

**ASSURANCE OF CONFIDENTIALITY:**

You understand that any information about you or your treatment will be handled in a confidential (private) manner. You will not be specifically identified in any publication of research results. However, in unusual cases, your research records may be inspected by appropriate government agencies or be released in response to an order from a court of law. Your name or information identifying you will not be released without written permission unless required by law.

The privacy of your health information is protected by a federal law known as the Health Insurance Portability and Accountability Act (HIPAA). If you choose to participate in this study, you will be asked to give permission for researchers to use and disclose your health information. Permission granted on this date to use and disclose your health information remains in effect indefinitely. By signing this form you give permission for the use and disclosure of your information for purposes of this study at any time in the future.

**INFORMATION TO BE COLLECTED:**

To perform this study, researchers will collect information regarding your health history, information from a physical exam, from diet and exercise and from all tests outlined under the section that describes the study.

The information collected about you will be used by Dr. Joseph E. Donnelly and his research team of coinvestigators and officials at KU that oversee research, including committees and offices that review and monitor research studies. In addition, we may share information with colleagues who are investigating similar research studies but will not share any information that would identify an individual. The researchers will not share information

about you with anyone not specified above unless required by law or unless you give written permission. Permission granted on this date to use and disclose your information remains in effect indefinitely. By signing this form you give permission for the use and disclosure of your information for purposes of this study at any time in the future.

**REFUSAL TO SIGN CONSENT AND AUTHORIZATION:**

You are not required to sign this consent and authorization form and you may refuse to do so without affecting your right to any services you are receiving or may receive from the University of Kansas or to participate in any programs or events of the University of Kansas. However, if you refuse to sign, you cannot participate in the study.

**CANCELING THIS CONSENT AND AUTHORIZATION:**

You may withdraw your consent to participate in this study at any time. You also have the right to cancel your permission to use and disclose information collected about you, in writing, at any time, by sending your written request to: Joseph E. Donnelly, 1301 Sunnyside Avenue, Robinson Center, RM 100, The University of Kansas, Lawrence, KS 66049. If you cancel permission to use your information, the researchers will stop collecting additional information about you. However, the research team may use and disclose information that was gathered before they received your cancellation, as described above.

**RIGHTS OF RESEARCH SUBJECTS:**

Your rights as a research subject have been explained to you. If you have any additional questions concerning your rights, you may contact the University of Kansas Advisory Committee on Human Experimentation, telephone (785) 864-3126.

**VOLUNTARY PARTICIPATION AND WITHDRAWAL FROM THE STUDY:**

Participation is voluntary. Your decision whether or not to participate will not affect you or your present or future relationships with the investigators or the University of Kansas. Your decision will not result in any loss of benefits to which you are otherwise entitled; however, you will lose the financial compensation originally offered. If any new information develops during the course of this study that may affect your willingness to continue participating, you will be informed immediately. You may withdraw your participation at any time and this will not affect your present or future relationships with the investigator or the University of Kansas.

**OFFER TO ANSWER QUESTIONS:**

The procedures for this study have been explained orally, by demonstration, or by visual aids. If you have any questions, please do not hesitate to ask and they will be answered at this time. If you think of any additional questions later, please feel free to contact one of the investigators listed below. If you have any questions concerning your right as a research subject you may contact the University of Kansas Advisory Committee on Human Experimentation, telephone (785) 864-3126.



YOU ARE VOLUNTARILY MAKING A DECISION WHETHER OR NOT TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE CERTIFIES THAT THE CONTENT AND MEANING OF THE INFORMATION ON THIS CONSENT FORM HAVE BEEN FULLY EXPLAINED TO YOU AND THAT YOU HAVE DECIDED TO PARTICIPATE HAVING READ AND UNDERSTOOD THE INFORMATION PRESENTED. YOUR SIGNATURE ALSO CERTIFIES THAT YOU HAVE HAD ALL YOUR QUESTIONS ANSWERED TO YOUR SATISFACTION. IF YOU THINK OF ANY ADDITIONAL QUESTIONS DURING THE STUDY, PLEASE CONTACT THE INVESTIGATORS. YOU WILL BE GIVEN A COPY OF THIS CONSENT FORM TO KEEP.

SIGNATURE OF SUBJECT \_\_\_\_\_ DATE \_\_\_\_\_

I AFFIRM I AM 18 YEARS OR GREATER AND HAVE RECEIVED A COPY OF THIS FORM. I HAVE READ AND UNDERSTAND THE OBLIGATIONS OF THIS RESEARCH STUDY. ANY QUESTIONS HAVE BEEN ANSWERED TO MY SATISFACTION.

SIGNATURE OF SUBJECT (Under 18 years of age only) \_\_\_\_\_ DATE \_\_\_\_\_

**I AM NOT YET 18 YEARS OF AGE. I HAVE RECEIVED A COPY OF THIS FORM. I HAVE READ AND UNDERSTAND THE OBLIGATIONS OF THE RESEARCH STUDY. ANY QUESTIONS HAVE BEEN ANSWERED TO MY SATISFACTION. I REALIZE I NEED MY PARENT OR GUARDIAN TO SIGN THIS CONSENT PRIOR TO MY PARTICIPATION IN THIS RESEARCH PROJECT.**

SIGNATURE OF PARENT OR LEGAL GUARDIAN \_\_\_\_\_ DATE \_\_\_\_\_

SIGNATURE OF PARENT OR LEGAL GUARDIAN IF SUBJECT IS UNDER 18 YEARS OF AGE. YOUR SIGNATURE CERTIFIES THAT THE CONTENT AND MEANING OF THE INFORMATION ON THIS CONSENT FORM HAVE BEEN FULLY EXPLAINED TO YOU AND THAT YOU HAVE GIVEN PERMISSION FOR YOUR CHILD/GUARDIAN TO PARTICIPATE HAVING READ AND UNDERSTOOD THE INFORMATION PRESENTED. YOUR SIGNATURE ALSO CERTIFIES THAT YOU HAVE HAD ALL YOUR QUESTIONS ANSWERED TO YOUR SATISFACTION. IF YOU THINK OF ANY ADDITIONAL QUESTIONS DURING THE STUDY, PLEASE CONTACT THE INVESTIGATORS. YOU WILL BE GIVEN A COPY OF THIS CONSENT FORM TO KEEP.

SIGNATURE OF WITNESS \_\_\_\_\_ DATE \_\_\_\_\_

IN MY JUDGEMENT THE SUBJECT AND/OR GUARDIAN IS VOLUNTARILY AND KNOWINGLY GIVING INFORMED CONSENT AND POSSESSES THE LEGAL CAPACITY TO GIVE INFORMED CONSENT FOR PARTICIPATION IN THIS RESEARCH STUDY.

PRINCIPAL INVESTIGATOR \_\_\_\_\_ DATE \_\_\_\_\_

Joseph E. Donnelly, ED.D. Phone: (785) 864-0797

**Appendix B:**  
**Questionnaires**

**CES-D SCALE**  
J.O.E. Study

Name: \_\_\_\_\_ Date: \_\_\_\_\_  
           First                  MI                  Last

SSN #: \_\_\_\_\_

Below is a list of feelings, attitudes, and behaviors that you may have experienced **DURING THE PAST WEEK**. Please use the following scale and circle the one response that best describes how often you have had these experiences **DURING THE PAST WEEK**. **Rarely or none of the time = less than one day; Some or a little of the time = 1 or 2 days; Moderately = 3 or 4 days; Most or all of the time = 5 to 7 days.**

**(Circle one number on each line)**

**During the past week...**

Rarely	Some of	Moderately	Most of
--------	---------	------------	---------

- |  |   |   |   |   |
|--|---|---|---|---|
| 1.) I was bothered by things that usually don't bother me .....                              | 0 | 1 | 2 | 3 |
| 2.) I did not feel like eating; my appetite was poor .....                                   | 0 | 1 | 2 | 3 |
| 3.) I felt that I could not shake off the blues even with help from family and friends ..... | 0 | 1 | 2 | 3 |
| 4.) I felt that I was just as good as other people .....                                     | 0 | 1 | 2 | 3 |
| 5.) I had trouble keeping my mind on what I was doing .....                                  | 0 | 1 | 2 | 3 |
| 6.) I felt depressed (blue or down) .....  | 0 | 1 | 2 | 3 |
| 7.) I felt that everything I did was an effort .....   | 0 | 1 | 2 | 3 |
| 8.) I felt hopeful about the future .....  | 0 | 1 | 2 | 3 |
| 9.) I thought my life had been a failure .....   | 0 | 1 | 2 | 3 |
| 10.) I felt fearful .....  | 0 | 1 | 2 | 3 |

11.) My sleep was restless .....	0	1	2	3
12.) I was happy .....	0	1	2	3
13.) I talked less than usual .....	0	1	2	3
14.) I felt lonely .....	0	1	2	3
15.) People were unfriendly .....	0	1	2	3
16.) I enjoyed life .....	0	1	2	3
17.) I had crying spells .....	0	1	2	3
18.) I felt sad .....	0	1	2	3
19.) I felt that people disliked me .....	0	1	2	3
20.) I could not "get going" .....	0	1	2	3

**NATIONAL INSTITUTES OF HEALTH – FAT SCREENER**

1. Think about your eating habits over the past 12 months. About how often did you eat or drink each of the following foods? Remember breakfast, lunch, dinner, snacks, and eating out. Blacken in only one bubble for each food.

TYPE OF FOOD	Never	Less than Once Per Month	1-3 Times Per Month	1-2 Times Per Week	3-4 Times Per Week	5-6 Times Per Week	1 Time Per Day	2 or More Times Per Day
Cold cereal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Skim milk, on cereal or to drink	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eggs, fried or scrambled in margarine, butter, or oil	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sausage or bacon, regular-fat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Margarine or butter on bread, rolls, pancakes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Orange juice or grapefruit juice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fruit (not juices)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beef or pork hot dogs, regular-fat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cheese or cheese spread, regular-fat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
French fries, home fries, or hash brown potatoes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Margarine or butter on vegetables, including potatoes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mayonnaise, regular-fat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Salad dressings, regular-fat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Margarine, butter, or oil on rice or pasta	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. Over the past 12 months, when you prepared foods with margarine or ate margarine, how often did you use a reduced-fat margarine?

- DIDN'T USE MARGARINE     
  Almost never     
  About 1/4 of the time     
  About 1/2 of the time     
  About 3/4 of the time     
  Almost always or always

3. Overall, when you think about the foods you ate over the past 12 months, would you say your diet was high, medium, or low in fat?

- High     
  Medium     
  Low

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Last MI First

SSN: \_\_\_\_\_

Please place an X under the column, which applies best to each of the numbered statements. All of the results will be strictly confidential. Most of the questions directly relate to food or eating, although other types of questions have been included. Please answer each question carefully. Thank you.

- 1- Never
- 2- Rarely
- 3- Sometimes
- 4- Often
- 5- Very often
- 6- Always

1 2 3 4 5 6

- |                          |                          |                          |                          |                          |                          |  |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 1. Engage in dieting behavior.   |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 2. Have the impulse to vomit after meals.                                  |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 3. Cut my food into small pieces.  |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 4. Eat diet foods.   |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 5. Feel uncomfortable after eating sweets.                                 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 6. Vomit after I have eaten.   |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 7. Take longer than others to eat meals.                                   |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 8. Enjoy trying new rich foods.  |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 9. Have gone on eating binges where I feel that I may not be able to stop. |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 10. Other people think that I am too thin.                                 |

- 11. Avoid foods with sugar in them.
- 12. Particularly avoid foods with high carbohydrate content.
- 13. Give too much time and thought to food.
- 14. Feel that others would prefer if I ate more.
- 15. Am preoccupied with a desire to be thinner.
- 16. Like my stomach to be empty.
- 17. Am preoccupied with the thought of having fat on my body.
- 18. Find myself preoccupied with food.
- 19. Feel that others pressure me to eat.
- 20. Am terrified about being overweight.
- 21. Avoid eating when I am hungry.
- 22. Think about burning up calories when I exercise.
- 23. Feel extremely guilty after eating.
- 24. Feel that food controls my life.
- 25. Display self-control around food.
- 26. Aware of the calorie content of food.

## Questionnaire 4

Listed below are a series of leisure time activities. Please read the list. For each activity selected, estimate the number of days per week and the average amount of time per day that you performed these activities during a typical week over the past 2-3 months. If you have not performed a particular activity, please leave the 0 in both the days of the week and session length boxes.

Section A: Walking and Miscellaneous	Number of Days a Week	Number of Minutes per Session
Walking to work or school	0	0
Cross Country Hiking	0	0
Back Packing	0	0
Mountain Climbing	0	0
Bicycling to Work and/or for Pleasure	0	0
Dancing - Ballroom, Square and/or Disco	0	0
Dancing - Aerobic, Ballet	0	0
Horseback Riding	0	0
Section B : Conditioning Exercises	Number of Days a Week	Number of Minutes per Session
Walking for Exercise	0	0
Jog/Walk Combination	0	0
Running	0	0
Weight Lifting	0	0



Section C: Water Activities	Number of Days a Week	Number of Minutes per Session
Water Skiing	0	0
Sailing in Competition	0	0
Canoeing or Rowing for Pleasure	0	0
Canoeing or Rowing in Competition	0	0
Canoeing on a Camping Trip	0	0
Swimming (at least 50 ft) at a Pool	0	0
Scuba Diving	0	0
Snorkeling	0	0
Section D: Winter Activities	Number of Days a Week	Number of Minutes per Session
Snow Skiing, Downhill	0	0
Snow Skiing, Cross Country	0	0
Snowboarding	0	0
Ice (or Roller) Skating	0	0
Sledding or Tobogganing	0	0
Section E: Sports	Number of Days a Week	Number of Minutes per Session
Bowling	0	0

Volley Ball	0	0
Table Tennis	0	0
Tennis, Singles	0	0
Tennis, Doubles	0	0
Frisbee (Ultimate)	0	0
Frisbee (Golf)	0	0
Skate Boarding	0	0
Softball	0	0
Badmiton	0	0
Paddle Ball	0	0
Racket Ball	0	0
Basketball: Non-Game	0	0
Basketball: Game Playing	0	0
Basketball: Officiating	0	0
Touch Football	0	0
Handball	0	0
Squash	0	0
Soccer	0	0
<b>Golf:</b>		

Riding a Power Cart	0	0
Walking, Pulling Clubs on a Cart	0	0
Walking and Carrying Clubs	0	0
Section F: Lawn and Garden Activities	Number of Days a Week	Number of Minutes per Session
Mowing Lawn with a Riding Mower	0	0
Mowing Lawn Walking behind a Power Mower	0	0
Mowing Lawn Pushing a Hand Mower	0	0
Weeding, Cultivating a Garden	0	0
Spading, Digging, Filling a Garden	0	0
Raking Lawn	0	0
Snow Shoveling by Hand	0	0
Section G: Home Repair Activities	Number of Days a Week	Number of Minutes per Session
Carpentry in Workshop	0	0
Painting Inside of House, includes Hanging Wallpaper	0	0
Carpentry Outside	0	0
Painting Outside of House	0	0
Section H: Fishing and Hunting	Number of Days a Week	Number of Minutes per Session

Fishing from Riverbank	0	0
Fishing in Stream with Wading Boots	0	0
Hunting Pheasants or Grouse	0	0
Hunting Rabbits, Prairie Chickens, Squirrels, Raccoon	0	0
Hunting Large Game: Deer, Elk, Bear	0	0



c. Do you take any "Herbal" medications? Y N

If yes,

Name(s)/Dosage(s): \_\_\_\_\_

Reason for taking: \_\_\_\_\_

d. Do you take any "Dietary Supplements" medications? Y N

If yes,

Name(s)/Dosage(s): \_\_\_\_\_

Reason for taking: \_\_\_\_\_

3. Have you seen a physician or been to a Clinic for illness in the last week? Y N

If "Yes", Please explain why: \_\_\_\_\_

4. **Females Only!!:**

a. Do you currently use a hormonal birth control method (i.e. pill, shot, patch)? Y N N/A

b. Have you made any changes in your hormonal birth control method? Y N N/A

If "yes", please explain why: \_\_\_\_\_