Fall 2009

Factors in BMI increase among multicultural freshmen.

Leah Haritan
San Jose State University

Follow this and additional works at: https://scholarworks.sjsu.edu/etd_theses

Recommended Citation

Haritan, Leah, "Factors in BMI increase among multicultural freshmen." (2009). *Master's Theses*. 3993.
DOI: <https://doi.org/10.31979/etd.ggbc-8daf>
https://scholarworks.sjsu.edu/etd_theses/3993

This Thesis is brought to you for free and open access by the Master's Theses and Graduate Research at SJSU ScholarWorks. It has been accepted for inclusion in Master's Theses by an authorized administrator of SJSU ScholarWorks. For more information, please contact scholarworks@sjsu.edu.

FACTORS IN BMI INCREASE AMONG MULTICULTURAL FRESHMEN

A Thesis

Presented to

The Faculty of the Department of Nutrition, Food Science, and Packaging

San José State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

by

Leah Haritan

December 2009

UMI Number: 1484328

All rights reserved

INFORMATION TO ALL USERS

The quality of this reproduction is dependent upon the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if material had to be removed, a note will indicate the deletion.

UMI 1484328

Copyright 2010 by ProQuest LLC.

All rights reserved. This edition of the work is protected against unauthorized copying under Title 17, United States Code.

ProQuest LLC
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106-1346

© 2009

Leah Haritan

ALL RIGHTS RESERVED

SAN JOSÉ STATE UNIVERSITY

The Undersigned Thesis Committee Approves the Thesis Titled
FACTORS IN BMI INCREASE AMONG MULTICULTURAL FRESHMEN

by
Leah Haritan

APPROVED FOR THE DEPARTMENT OF NUTRITION, FOOD SCIENCE
AND PACKAGING

12/14/09

Marjorie R. Freedman, Ph.D., Department of Nutrition, Food Science & Packaging Date

12/14/09

Kathryn Sucher, Sc.D., R.D., Department of Nutrition, Food Science & Packaging Date

12/14/09

Jennifer Waldrop, MPH., R.D., Student Health Center, San José State University Date

APPROVED FOR THE UNIVERSITY

2/5/10

Associate Dean Office of Graduate Studies and Research Date

ABSTRACT

FACTORS IN BMI INCREASE AMONG MULTICULTURAL FRESHMEN

by Leah Haritan

This observational research examines body mass index (BMI) changes in multicultural freshmen attending a large public urban university. It explores factors associated with BMI increase and investigates behavior changes and perceptions related to diet and body weight. The study utilizes an online survey distributed in November 2007 and again in April 2008. All 3,260 freshmen were eligible to participate. Initial response rate was 23%; 44% of initial respondents completed both surveys ($N = 337$). Results revealed a significant increase in BMI for on-campus residents, Caucasians, and males ($P < 0.05$). Decreased vegetable intake was associated with a BMI increase of less than one ($P < 0.05$). Fruits and vegetables were perceived by most as healthful; their high cost, and limited variety and availability on campus were deemed potential barriers to intake. Freshman weight gain may be a function of gender, residence, and ethnicity, and deserves further examination.

ACKNOWLEDGEMENTS

I would like to thank everyone who made this project possible. First, thank you to Dr. Freedman who inspired this study, provided me with instruction and guidance, and served as a sounding board and a mentor. Second, I would like to thank my sons Itamar and Yiphtach for their continued encouragement, and my husband whose love and great support were essential for the completion of this work. Third, I would like to thank Lori Turk who helped me improve my understanding of statistics. Fourth, I would like to thank Dr. Sucher, Jennifer Waldrop, and Dr. Hollenbeck for providing me with their insightful input.

PREFACE

The journal article was written and formatted according to the publication guidelines of the *American Journal of Health Behavior*. The remainder of the manuscript was written according to the *AMA Manual of Style, 10th Edition*.

TABLE OF CONTENTS

	Page
CHAPTER 1: Introduction and Literature Review	1
Introduction	2
Literature Review	3
Dietary and Physical Activity Behaviors among Adolescents	3
Dietary and Physical Activity Behaviors among College	6
Students	6
Prevalent Lifestyle Behaviors among College Freshmen	8
Diet and physical activity	8
Dietary restraint	14
Negative health behaviors among freshmen	15
Factors that May Influence Behaviors and Weight in College	18
Freshmen	18
Perceptions of the transition to college life	18
Knowledge	19
Initial body weight	21
Gender	23
Ethnicity	30
Residence	34
Validity of Self-Reported Data	37
CHAPTER 2: Journal Article	39

Abstract	40
Introduction	40
Methods	42
Research Design	42
Subject Recruitment	42
Survey Design and Measures	43
Data Analysis	44
Results	45
Participants	45
BMI Change	46
Changes in Behaviors	48
Perceptions of Diet, Intake of Fruit and Vegetables, and Own	52
Body Weight	52
Dietary Restraint	56
Discussion	56
Ethnicity	56
Residence	57
Gender	59
Initial BMI	59
Behavior Change by BMI Change	61
Dietary Restraint	61
Intake and Perception of Fruit and Vegetables	62

Perceived Importance of Body Weight and Diet	63
Conclusion	63
References	65
CHAPTER 3: Summary and References	69
APPENDIXES	77
A. Consent Forms	77
B. IRB Approvals	80
C. Survey Instruments	83

LIST OF TABLES

	Page
Table 1. Participants' Baseline Characteristics	46
Table 2. BMI Changes Fall to Spring	47
Table 3A. Behavior Changes by BMI Change	48
Table 3B. Behavior Changes by Ethnicity	49
Table 3C. Behavior Changes by Residence	50
Table 3D. Behavior Changes by Gender	51
Table 3E. Behavior Changes by iBMI	52
Table 4. Perceptions of Fruit and Vegetables, Diet, and Body Weight by BMI Categories	53
Table 5. Perceptions of Fruit and Vegetables by Residence	55

CHAPTER ONE

INTRODUCTION AND LITERATURE REVIEW

INTRODUCTION

The prevalence of overweight (body mass index [BMI] = 25 - 29.9 kg/m²) and obesity (BMI ≥ 30) has increased significantly in the United States over the past 20 years.¹⁻⁴ Currently, over two-thirds of adult Americans aged 20 to 74 are overweight,⁴ and have an increased risk of chronic diseases, such as type 2 diabetes, hypertension, cardiovascular disease, and some cancers.⁵⁻⁶ Treatment of obesity and associated morbidities is often difficult and expensive,⁷ thus making prevention of weight gain critical. Since adult obesity is associated with late-adolescent obesity,⁸ understanding the factors leading to weight gain during adolescence is necessary.

The transition from adolescence to adulthood is often marked by newfound independence, newly adopted lifestyles, and subsequent weight gain, reported as early as the first semester of college,⁹⁻¹³ and continuing in some cases, throughout the entire freshman year.¹⁴⁻²⁸ This phenomenon is known in the popular media as “The Freshman 15,”^{9,17} because of the assumption that 15 lb are gained by students in the first year of college. However, in peer-reviewed studies the weight gain has been reported to be less than this, at between 1.5 and 5.5 lb.⁹⁻²⁸ In these studies, methodological problems, including small sample sizes, lack of gender and ethnic diversity,^{10,14,16,20-22,24-28} and limited examination of residence, make data difficult to generalize to larger, more ethnically diverse populations that include students who live on and off campus. Further, many studies use change in body weight rather than change in BMI as the primary outcome.^{9,12,13,15-17,20-28} This is problematic in a population that is still growing in height.²⁹

Despite methodological problems, several studies have attempted to explain weight gain in this population by examining behaviors related to food intake and physical activity. For example, when looking at food intake, consuming fewer fruit and vegetables and more meats and legumes was associated with higher weight.^{23,30} With respect to physical activity, vigorous and moderate physical activity and strength training were associated with weight maintenance in one study, however reduction in physical activity was a better predictor of weight gain than changes in food intake in another study.^{14,16,19} These studies lead to the conclusion that freshman weight gain is a multifactorial phenomenon, for which there is not a “one-size fits all” answer. Causes of weight gain in an ethnically diverse group of freshmen that live at home have not heretofore been studied.

LITERATURE REVIEW

Dietary and Physical Activity Behaviors among Adolescents

Low intake of fruit and vegetables, high intake of carbonated soft drinks, and skipping breakfast, have been linked to adolescent weight gain, while high intake of fruit and vegetables have been linked to lower body weight.^{23,31} Low levels of physical activity may also be a factor in adolescent weight gain. The growing prevalence of obesity in adolescents calls for examination of these factors as potential explanations for BMI increases among college freshmen, most of who are adolescents. According to the Youth Risk Behavior Surveillance--United States 2007,³² nearly 80% of high school students reported consuming less than the recommended daily intake of 5 servings of fruit and vegetables during a period of 7 days prior to the survey. In addition, 33.8%

reported they had a carbonated beverage at least once a day and 65.3% did not meet the recommendations for physical activity for 18 to 65 year olds, suggested by the American Heart Association (ie, a minimum of 60 minutes of physical activity at an increased heart rate, for least 5 times per week.)³³

Fruit and vegetables are low in calories and high in nutritional value. Therefore, the intake of fruit and vegetables is considered to be an essential part of a healthful diet. Examination of fruit and vegetable intake among adolescents aged 12-18 years (as collected in the 2003-2004 NHANES 24-hour dietary recall)³⁴ revealed only a very small minority of people meets the United States Department of Agriculture (USDA) recommended intake. Furthermore, adolescents consumed less whole fruit and more fruit juice compared to adults and their median vegetable intake was significantly reduced when fried potatoes were excluded. Orange juice was the major source for total fruit intake, and both fried and non-fried potatoes were the major source for total vegetable intake. Among adolescents, intake was similar for both genders and all demographic groups.

Intake of carbonated soft drinks (CSD) in the United States has increased 52% from 1977-1978 to 1994, with an increase of 74% and 65% in CSD intake among male and female teens aged 12 to 19 years, respectively.³⁵ A review of 88 studies that examined the relationships between intake of soft drinks, energy intake, and body weight showed a low positive effect on BMI, with an overall effect size of 0.08 for all relevant studies ($P < 0.001$), and a higher effect size of 0.24 ($P < 0.001$), when only the experimental studies that controlled for many variables were considered.³⁶ The review

also showed a significant positive effect on energy intake with an overall effect size of 0.16 ($P < 0.001$). Another study examining food intake patterns following solid compared to liquid carbohydrate intake reported that the solid carbohydrate load was associated with an adjusted reduced “free-feeding” energy intake.³⁷

Project EAT (Eating Among Teens) was a 5-year longitudinal study that involved students from 31 middle and high schools in Minnesota and evaluated eating habits among adolescents in association with body weight.³⁸ Data were collected from 2,216 participants during the 1998-1999 as well as the 2003-2004 school years. In this study, breakfast frequency was classified as “daily”, “intermittent” (ie, irregular intake of 1 to 6 days per week), or “never”. Results indicated that low breakfast frequency was associated with higher BMI levels at both time points in a dose-response manner ($P < 0.01$), independent of other confounding factors such as dietary intake, weight loss practices, smoking and alcohol use, and physical activity. Breakfast frequency was also negatively associated with dieting and weight control behaviors suggesting that skipping breakfast may erroneously be practiced as a means of weight control. Additionally, participants that reported “daily” breakfast also reported higher levels of physical activity compared to others, further suggesting that skipping breakfast may be considered a marker for a variety of unhealthful behaviors.

Breakfast frequency was further found to be negatively associated with BMI increase in a study conducted on data collected from 9,919 adolescents in the National Longitudinal Study of Adolescent Health over a period of 5 years.³⁹ Results of this study

indicated that low frequency of breakfast meals early in the study was associated with an increase in BMI later in the study, conducted for ages 18 to 27 ($B = -0.01$, $P < 0.05$).

Dietary and Physical Activity Behaviors among College Students

The following 2 studies describe prevalent dietary and physical activity behaviors among college students. The first study examined breakfast skipping, and found it to be a prevalent dietary behavior among college students in a southeastern university.⁴⁰ This descriptive study examined dietary behaviors of 707 students (19% freshmen, 23% sophomores, 26% juniors, 25% seniors, and 7% graduate students) and reported that 44.2% of participants never or seldom had breakfast, and only 36.6% reported having breakfast on a daily basis. This study also reported that intake for fruit, vegetables, breads, dairy, and meat were lower than USDA recommendations.⁴¹ The recommended intake for fruit was met by only 31.2%, for vegetables by only 1.3%, for bread, cereal, rice, and pasta by only 6.9%, for milk, yogurt, and cheese by 53.1%, and for meat, poultry, fish, dry beans, eggs, and nuts by 65.5%. However, intake was determined by using a 24-hour diet recall, which may not be representative of usual intake.

The second study, a cross-sectional survey conducted at the University of Kansas, involved a convenience sample of 736 college students (90.7% white, aged 18 to 27 years). The study evaluated self-reported height and weight in relation to diet and physical activity.⁴² Data were collected in the Spring of 2001 and again in the Spring of 2002 and results indicated that on average 69.4% of participants had < 5 servings of fruit and vegetables daily, and over 67.1% had < 20 g fiber daily. Fiber intake for female

students was significantly lower than that of male students ($P < 0.001$) and most students reported physical activity < 30 min/day on most days.

The following 2 studies examined relationships between college students' behaviors and body weight. The first study used data collected from the 1995 National College Health Risk Behavior Survey, which examined relationships between dietary preferences, physical activity, weight management, and body weight among 4,609 U.S. college students.⁴³ Nearly half the students (45.6%) were undergraduates at 2-year college institutions and showed a greater tendency to be overweight or obese compared to students that attended 4-year colleges, whereas diet and exercise behaviors did not differ between the 2 populations. Results further indicated that of students that attended 2-year colleges 51.3% were 25 years or older and 34.9% were employed full time, compared to students that attended 4-year colleges where 24.1% were 25 years or older and only 13.4% that were employed full time. This suggests that differences in proportions of overweight and obesity between the 2 populations may be related to a range of external factors, such as time management and other life stressors that interfere with healthful lifestyles. Additional results showed that only one third of students reported receiving nutrition and health information at college. However, reported weight management was associated with vigorous and moderate physical activity, strengthening exercises, intake of five or more daily servings of fruit and vegetables, and intake of ≤ 2 daily servings of high-fat foods, suggesting a basic understanding among college students of the association between diet, exercise, and body weight.

The second study involved 557 college students, who were recruited from among 713 students enrolled in a mandatory class “Principles of Nutrition,” where 28.6% were freshmen, 38.9% were sophomores, and the rest were juniors, seniors, and above.⁴⁴ Almost 35.4% were on-campus residents, 58.9% were off-campus residents and the remainder lived with their families. Sixty percent were females, 75% were ≤ 21 years old, and 96% were white. Of the sample, 27% were overweight and 8% were obese. The study involved a Diet Variety Questionnaire that collected food group intake based on a 3-day dietary record, and also collected self-reported height and weight used to calculate BMI. Results showed that underweight students with a BMI < 19 consumed more cheese, green leafy vegetables, other vegetables, hot cereal, and dairy compared to others ($P < 0.05$). Students who were obese with a BMI ≥ 30 had a higher intake of pork, fish, legumes, and all meats compared to others ($P < 0.05$). However, the authors acknowledged that a 3-day diet record probably does not represent usual dietary intake. Additionally, reported intake may have been affected by the newly acquired nutrition knowledge.

Prevalent Lifestyle Behaviors among College Freshmen

Diet and physical activity. Jung et al¹⁹ conducted a study aimed at assessing the association between changes in dietary practices and physical activity with changes in weight in a group of 101 first-year college women. Data were collected 4 times during a period of 12 months and when analyzed gave comprehensive information on caloric intake. Data included 3-day food records, physical activity measures based on the Godin Leisure Time Questionnaire, and body weight and body composition measurements.

Average overall weight gain was 3.08 lb, where 34% lost an average of 5.3 lb and had a significant decrease in body fat, [$t(34) = -4.02$, $P < 0.01$]. Sixty-six percent gained an average of 7.54 lb and had a significant increase in body fat, [$t(65) = 3.32$, $P = 0.001$]. Both groups showed a significant decrease in caloric intake, [$t(63) = 2.91$, $P = 0.05$; $t(33) = 3.46$, $P = 0.01$, respectively], as well as reduced levels of physical activity, with a significantly greater reduction among those that gained weight compared to those that lost weight, [$F(3,294) = 2.95$, $P = 0.04$]. This suggests that physical activity is a major factor in weight gain. However, all participants were female students residing on campus and ethnic distribution of participants was not provided.

Physical activity as a significant factor in weight gain has also been supported by a study conducted on first-year female college students residing on campus in a large Midwestern university.¹⁴ The initial sample included 82 female incoming first-year students, of whom 92.7% were white. A follow-up sample of 52 participants was conducted after 5 months. Data collected included measured height, weight, and body composition, dietary intake by using The Block Food Frequency Questionnaire, physical activity by using The Queens College 3-Minute Step Test performed by an exercise physiologist, the Baecke Questionnaire of Habitual Physical Activity, and a self efficacy test adapted from the Sallis Exercise and Nutrition Self Efficacy Questionnaire. Results indicated a significant increase in body weight by 1.59 lb and in BMI by 0.27 ($P < 0.01$), as well as in the percentage of body fat and fat mass ($P < 0.001$). However, total caloric intake and total physical activity significantly decreased ($P < 0.05$), which suggested

weight gain was due to the reduced levels of physical activity rather than to an increase in intake. Study limitations included a small sample size, and the use of self-reported data.

The critical role of physical activity in the possible prevention of weight gain, especially during the freshman year, was further supported by a Canadian study,¹⁶ which involved 116 women, 89% white. Data were collected prior to the first school year and twice during freshman year, and included measured body weight and height, body composition, and waist circumference. Participants provided a 24-hour dietary recall that was analyzed using the Canadian Nutrient File. Information on physical activity, measured in times per week, was based on questions from the Canadian National Longitudinal Survey of Children and Youth and the U.S. National Youth Risk Behavior Survey. Results showed a significant overall increase in body weight of 5.3 lb (2.4 kg) and in weekly frequency of vigorous physical activity ($P < 0.03$), where dietary intake was not significantly changed. The proportion of normal weight and underweight participants decreased from 79% to 75% and from 8% to 6% respectively, and the obese population remained at 3% while the proportion of overweight participants increased from 15% to 22%. Multiple regression analysis revealed that higher initial weight and decreased physical activity predicted weight gain ($P < 0.001$ and $P < 0.007$ respectively) and were the only two significant predictors of weight gain. The study's limitations included possible underreported levels of intake, bias by participation of health-aware students, and the fact that all participants were females who resided away from home.

Hajhosseini et al¹¹ conducted a study on a large urban university and examined changes in measured body weight, body composition, resting metabolic rate, and dietary

intake of a small sample of 27 freshman students during their first semester on campus. The majority of participants were female (80%), while 44% were Asian-American, 37% were white, 11% were Hispanic, and 8% were African-American. Results indicated a statistically significant increase in mean body weight of 3 lb ($P < 0.001$) and in mean percent fat mass from 30.1 ± 1.1 to 32.2 ± 1.3 ($P = 0.001$) and a decrease in mean percent lean body mass from 69.9 ± 1.1 to 67.8 ± 1.3 , which suggests possible changes in physical activity that were not evaluated in this study. Additionally, the authors stated that due to the very small sample size significant findings might have been limited.

Yet another study examined changes in BMI and body composition over the course of the freshman year and involved actual measurements of 137 freshman females at the University of Oklahoma.²² The majority of students lived on campus (96%) and 85% were white. Results indicated a significant increase of 2.42 lb in mean body weight and of 0.8% in mean percentage of body fat ($P < 0.001$). Dual energy X-ray absorptiometry (DXA) measurements showed that 27% of the increase in weight was due to increase in lean body mass. Therefore, the authors stated that the results of this study did not support the “Freshman 15” phenomenon. Still, one major limitation of this study was the use of a self-selected population of lean females (initial mean BMI was 21.9 ± 2.5), who were moderately or vigorously physically active, which may have affected results.

Similarly to the University of Oklahoma study,²² Hoffman et al¹² showed an increase of 2.86 lb (1.3 kg) in mean body weight from September to April, and a 0.7% increase in body fat among 67 freshmen living on campus. As measured by DXA, for

students who gained weight, mean body weight increased by 6.82 lb (3.1 kg) and body fat increased by 0.9%, which constituted 2.64 lb (1.2 kg), where the remaining 3.96 lb (1.8 kg) constituted gain in lean body mass. The majority of students were white (67%) and the gender representation was equal. The authors indicated no significant differences between genders or between different ethnic groups. The authors further suggested possible factors that may have contributed to weight gain that included overeating in the cafeterias, poor food choices, and alcohol consumption, as well as decreased physical activity. However, these factors were never examined in this study and do not explain the increase in lean body mass.

In a study of 113 freshmen that were enrolled in a basic psychology class at the University of Toronto in Canada, Pliner and Saunders²³ measured students' height and weight, and collected dietary intake by using a Food Frequency Questionnaire. They rated students' quality of diet by using an index of "unhealthy eating" based on consumption of high-fat meats and snacks, non-diet soft drinks, fruit, raw vegetables, and cooked vegetables. Results showed that one of the significant predictors of weight gain was reduced intake of fruit and vegetables ($P < 0.05$). However, as the authors stated, exercise levels and other potential factors that may have affected weight change were not assessed.

Kasparek et al²⁰ also examined effect of intake of fruit and vegetables, as well as physical activity, on weight change of 193 college freshmen. Data were collected by way of an online survey conducted in the Fall and Spring semesters based on items from the Youth Risk Behavior Surveillance and the Block Reduced Food Frequency

Questionnaire. Almost 88% of participants were female, 80.8% were white, 94.8% lived on campus, and 94.3% were on a meal plan. Over half the participants reported a mean weight gain of 7.1 lb, where 23.8% reported weight loss and 19.2% reported no change in weight. Mean overall weight significantly increased by 2.5 lb ($P < 0.01$) with a mean BMI increase from 23.18 to 23.5, and intake of fruit and vegetables significantly decreased from Fall to Spring. However, even though participants of BMI levels > 25 were less likely to be active compared to others ($P = 0.029$), there were no significant associations between physical activity, intake of fruit and vegetables, and weight change. As in previous studies, results of this study are limited to female white students living on campus.

Similarly to Kasperek et al,²⁰ Racette et al²⁴ conducted a study that involved a convenience sample of 764 freshmen at Washington University in St. Louis, with a follow-up on 290 students at the end of their sophomore year, that evaluated dietary and physical activity behaviors. Results indicated no significant changes in consumption of daily fruit, vegetables, and high-fat fast foods, and no significant correlations between changes in dietary or exercise behaviors with changes in body weight between the beginning of freshman year and the end of sophomore year. In this study, classification of exercise behaviors was based on the recommendations of the American College of Sports Medicine and classification for healthy dietary behaviors was adopted from the “Five-a-Day” program, and included daily consumption of 5 or more fruit and vegetables, limited consumption (<3 times per week) of fried foods and high-fat fast foods, and daily intake of 64 ounces of non-caffeinated non-alcoholic beverages. Results showed a

significant increase in mean body weight of 9.02 lb in 70% of the 290 students by the end of sophomore year ($P < 0.001$) and a decrease in weight among 26% of students. The proportion of students who participated in aerobic exercise 3 to 5 days per week and the proportion of students who consumed fried foods ≥ 3 per week significantly declined ($P = 0.039$, $P = 0.004$ respectively), whereas the proportion of students who participated in stretching exercises significantly increased ($P = 0.007$). An additional assessment of 118 students at the end of freshman year showed an increased body weight of 5.5 lb (2.5 kg) ($P < 0.001$). The authors stated that weight gain might have been due to an increase in lean muscle mass (but this was not assessed since body composition was not measured), that dietary behaviors were only based on the prior week and might not have been representative of usual intake, and that housing changes during sophomore year might have been factors in behaviors and weight change.

Results from most of the studies described here, with the exception of Racette et al.²⁴ and Kasparek et al.,²⁰ suggest that reduced physical activity during freshman year is a more significant factor in freshman weight gain than dietary intake.

Dietary restraint. The association between dietary restraint and weight gain was examined in a study that involved 69 first-year female students.²⁸ Mean overall weight gain was 4.62 lb (2.1 kg) and although dietary restraint was not shown to be predictive of weight gain, students who were currently engaged in weight loss and dietary restraint gained more weight (11 lb) compared to those that had practiced dietary restraint in the past (5.5 lb) and compared to those that had not reported practicing dietary restraint at all

(3.52 lb). Since the number of students who currently practiced dietary restraint was very small ($n = 7$), significance of results is limited.

A study that involved 149 first-year college women enrolled in a general psychology class and that examined the association between BMI changes and dietary restraint¹⁵ showed that mean weight gain was 3.36 lb, where 63% gained weight, 13% stayed the same, and 24% lost weight. Weight gain was significantly higher in those that lost weight at the beginning of the study compared to others [$t(122) = 0.36$, $P = 0.05$]. Dietary restraint was the only significant difference between those that gained weight and the others. The small number of ethnicities other than Caucasian (who comprised 62% of the sample) was a study limitation.

In Pliner and Saunders' study,²³ students were also required to use a validated Restraint Scale in order to rate themselves as restrained or unrestrained eaters. Results indicated that overall weight gain was 3.3 lb. However, for students who reported dietary restraint, BMI increase was significantly higher for those that lived on campus compared to those that lived off campus ($P < 0.01$), whereas BMI changes of unrestrained eaters were not significantly different between on-campus and off-campus students. When weight change was considered instead of BMI change, the single significant predictor of weight gain was the interaction between living conditions and dietary restraint [$t(66) = 2.31$, $P < 0.05$].

Negative health behaviors among freshmen. To identify a susceptible target population suitable for future intervention to prevent freshman weight gain, it may be beneficial to distinguish between students who partake in behaviors that are considered

unhealthful and those who do not. A study conducted by Hendricks et al⁴⁵ that involved 93 first-year college women concluded that unhealthful behaviors are usually practiced together. Data were collected by using a survey based on a validated adolescent Food Frequency Questionnaire, as well as on the Youth Risk Behavior Surveillance Survey, and results showed that students who smoked had a lower fiber intake and a higher alcohol intake compared to students who did not smoke ($P < 0.05$), and that physical activity was significantly positively associated with intake of fruit, vegetables, whole grains, legumes, and fish ($r = 0.22$, $P < 0.05$).

Alcohol intake is another unhealthful behavior that is thought to be prevalent among college students. Butler et al¹⁴ reported that alcohol intake among freshmen increased from a mean of 0.25% of total calories to 1.23% by the end of freshman year. In addition, the number of daily alcohol beverages also increased from a mean of 0.04 to 0.16 ($P < 0.05$). A study that involved 282 college freshmen reported that over 65% of students who reported alcohol intake in the previous month were not aware of caloric value of the alcoholic drinks they had consumed.⁴⁶ Of the participants in this study, 25% were classified as “moderate-risk drinkers” (an alcohol intake of 4 to 5 drinks 1 to 3 times per week), 48% were classified as “low-risk drinkers” (an alcohol intake of 2 to 3 drinks 1 to 2 times per month), and 27% were classified as “non-drinkers”. Results showed that “moderate-risk drinkers” were more likely to have a higher food intake and make less healthful food choices after drinking compared to others, and they had a higher increase in BMI compared to “low-risk drinkers” ($P < 0.01$).

A recent study that evaluated alcohol use, eating patterns, and weight among 3,206 college students, of which 63% were undergraduates, further supported the suggested relationship between alcohol intake and diet,⁴⁷ and showed a significant positive association between “alcohol related eating” defined as “eating before and/or during drinking” and overweight classification in first- and third-year students compared to others. Binge drinking, defined ≥ 5 drinks at a sitting, was found to be associated with “skipping” breakfast, intake of <5 daily servings of fruit and vegetables, high intake of fast food, and body discontent, as well as >1 unhealthy behavior of weight control. However, binge drinking was also positively associated with physical activity.

In an older study that was originally aimed at examination of potential predictors of BMI change in college students, researchers evaluated over a period of 2 years (1992-1993) a sample group of 116 students who were part of a larger longitudinal study of students who had completed a mandatory Health Risk Appraisal.⁴⁸ Regression analysis showed that females who had an increase in BMI levels were more likely to regularly use alcohol and caffeine, to have a low fiber intake, and to lack adequate coping mechanisms. However, this study was based on behaviors that were recorded some 15 years ago and conclusions may have changed due to differences in environmental factors.

Although not all studies described here have examined the effect of unhealthful behaviors among students on weight, they all support the suggestion that unhealthful behaviors, such as alcohol intake, are usually practiced together among students and affect dietary intake, which may subsequently lead to weight gain. However, studies that collect self-reported data of alcohol use among freshman students may have inaccurate

data, as underage freshmen may be reluctant to be truthful about their consumption of alcohol.

Factors that May Influence Behaviors and Weight in College Freshmen

Evaluation of factors in the “freshman experience” can help crystallize understanding of freshman weight gain. Although many of the studies discussed here explore college students in general, as well as the general population, external effects impacting weight gain in the freshman population, in particular, may be further amplified due to additional changes experienced in the freshman year.

Perceptions of the transition to college life. Freshman behaviors, dietary or other, are often the result of the transitional processes that come from moving into a new college environment. A study by Cluskey and Grobe¹⁰ explored behavior transitions among college freshmen. The authors examined weight and BMI changes 8 weeks apart during freshman year among 379 college freshmen, 60% males and 40% females, 86% white. Seventy percent declared they were away from home for the first time. A total of 62% of participants gained weight, where 27% gained more than 5.06 lb (2.3 kg). Cluskey and Grobe went on to explore transition perceptions of a subset of 19 students by using 4 focus groups that were assembled by gender and conducted towards the end of the school year. Nearly all focus group participants agreed that college transition was difficult and some mentioned that maintenance of a healthful lifestyle was challenging due to environmental circumstances, such as lack of family support and lack of routine physical activity compared to the past. However, some participants expressed a sense of accomplishment in their ability to maintain an active lifestyle, to achieve greater

independence, and to have greater responsibility of food preparation. Many agreed that maintenance of healthful dietary practices was more challenging than maintenance of physical activity, especially since food venues on campus were not perceived as providers of healthful food choices, and many referred to the potential negative influence of peers. In addition, students living off campus expressed great financial and time management challenges in the planning and preparation of healthful meals. This study was mostly exploratory and the authors did not provide mean values for overall weight change or statistical analysis of possible associations.

Knowledge. The suggestion of knowledge as a factor that influences eating habits was supported by a study that involved a small sample of 40 college freshman females.⁴⁹ Approximately half the participants were asked to take a semester-long college class of diet, human physiology, and energy metabolism, and all participants were measured for body weight and knowledge at baseline, at the end of the course and at 1 year after the end of the course. Dietary intake was recorded by utilizing a validated 116-item Food Frequency Questionnaire. Results indicated that although knowledge at baseline was significantly lower for the intervention group compared to the control group ($P < 0.05$), by the end of the course, participants reported significantly lower energy intake compared to control group members ($P = 0.013$). However, differences in reported intake vanished by the end of the year. The authors further suggested cautious interpretation due to the small sample size, the self-selected population that may have already been interested in weight reduction, and the different modalities of education that may or may not have affected results. Long-term effects were not evaluated.

The effect of knowledge on dietary intake was further supported by a cross-sectional study that involved a convenience sample of 193 college freshmen on a university meal plan.⁵⁰ Dietary intake and physical activity data were collected based on the MyPyramid Food Guidance System and the perceived importance of dietary guidance on intake was collected based on the USDA Diet and Health Knowledge Survey. Only 18% of respondents were classified as overweight and most students reported very low sedentary behavior patterns. Results showed that students who had greater dietary knowledge also reported a recommended level of intake of fruit and dairy, and a lower than recommended intake of protein compared to others. The authors attributed dairy intake to the 2003 \$2 million dairy campaign and the 2004 “Three a Day of Dairy for Weight Loss” campaign that may not have involved sufficient and proper promotion of overall knowledge of diet and nutrition. The impact of these campaigns suggests that the level of nutrition knowledge is associated with food choices. However, the study did not examine relationships between knowledge and weight.

Information on health and nutrition provided by professionals was also found to be significantly positively correlated with physical activity and body image ($P < 0.01$) and related to a decrease in disordered eating behaviors among 210 first-year college women in a study conducted by Rich and Thomas⁵¹ that used an Eating Attitudes Test to assess dieting behaviors and attitudes. However, due to differences in results between ethnicities, the effect of the provided information needs to be assessed in a socio-cultural context.

Contrary to studies described here, Lowry et al⁴³ suggested an existent basic understanding among college students of the association between diet, physical activity, and body weight regardless of the availability of information on campus. However, as described by Kolodinsky et al,⁵⁰ access to information can be by way of multiple avenues and not necessarily by way of academic classes and campus handouts.

Initial body weight. In his study, Matvienko et al⁴⁹ showed that following an intervention of an informational class, students with BMI > 24 reported lower intake of fat, protein, and carbohydrates compared to the control group ($P < 0.05$), and exhibited weight maintenance throughout the year compared to a weight gain of 20.2 lb among the control group ($P = 0.012$), which led the authors to suggest that educational intervention was mostly effective in people who were at risk of becoming overweight.

Anderson et al⁹ reported a statistically significant measured overall weight gain of 2.86 lb (1.3 kg) among 135 mostly white (81%) female (57%) freshmen from September to December 2002 ($P < 0.01$), with 70% gaining less than 5.07 lb (2.3 kg), 26% gaining more than 5.07 lb, and 4% losing more than 5.07 lb. Fourteen percent of the normal weight participants ($BMI < 25$) became overweight or obese ($BMI \geq 25$) by December, increasing the proportion of these students from 15.6% and 5.2% in September to 25.2% and 6.7% in December, respectively. A follow-up in May on a subset of 46 students revealed that observed additional weight gain from December through May was not statistically significant ($P > 0.05$), which was likely due to the small sample size made up of mostly (80%) normal weight individuals. Anderson et al⁹ concluded that freshman year is a crucial time for weight gain mainly for those who are overweight and obese.

However, this conclusion was based on the significant increase in the proportion of overweight and obese individuals that were initially of normal weight. Additionally, the study did not examine other factors that may have caused the weight change.

Levitsky et al¹³ examined weight gain patterns of 60 freshmen at Cornell University during the first 12 weeks of college and found that mean weight gain was 4.2 lb (1.9 kg). Multiple regression analysis revealed that consumption of high-fat foods and evening snacks each accounted for 12% of total variance in the weight gain, and consumption of breakfast and lunch at an all-you-can-eat facility each accounted for 10% of the total variance in weight gain ($p < 0.05$). However, when initial body weight was included as a covariate, consumption of junk foods was the major variable responsible for 24% of the variance in weight gain, frequency of meals on weekends was responsible for 17%, recent dieting was responsible for 9%, and consumption of evening snacks was responsible for 6% of the variance ($P < 0.05$). The authors suggested that differences in results might be explained by the tendency of heavier students to eat more when portion sizes are larger or when they dine at an all-you-can-eat facility, and that dining facilities should be held accountable for over-consumption of food by students. However, the authors referred to possible limitations of their study, which included self-selected participants, inadequate evaluation of physical activity, and unequal representation of females and males (ie, 85% of participants were females). Additionally, participants were recruited from 2 courses, 1 of which was a course related to nutrition and human development, and the 2 groups were not distinguished from each other in this study. Moreover, 77% of participants were Caucasian, which limits generalization to the larger

population, and self-reported intake relied on self-evaluation of meal size, which leaves room for erroneous interpretation. The study's advantage was that the authors weighed and measured the participants.

Kasperek et al²⁰ reported that students who were initially classified as overweight ($\text{BMI} \geq 25$) had a mean weight gain of 10.96 lb, significantly higher than students initially classified as having “desirable” weight ($\text{BMI} < 25$) who had a mean weight gain of 6.21 lb ($P < 0.001$). These results were further supported by Edmonds et al¹⁶ where multiple regression analysis revealed that higher initial weight was a significant predictor of higher weight gain ($P < 0.001$). On the other hand, findings by Mihalopoulos et al²¹ showed that students with initial $\text{BMI} < 25$ had a higher gain in weight at an average of 3.3 lb compared to students with initial $\text{BMI} > 25$ whose weight gain was 0.8 lb on average. However, these findings were statistically insignificant ($P = 0.07$).

Initial weight may or may not be a significant predictor of weight gain and needs further study.

Gender. Several studies have shown significant differences in dietary and physical activity behaviors between male and female college students. Huang et al⁴² found that male college students were more likely to be overweight compared to females and that their fiber intake was significantly higher than that of female college students ($P < 0.001$). According to Lowry et al⁴³ female college students were more likely than males to perceive themselves as overweight and to attempt losing weight by means of diet, exercise, pills, vomiting, or laxatives. Females were also more likely than males to eat < 2 daily servings of high-fat foods, and less likely than males to take part in vigorous

physical activity. However, in both genders losing weight and weight maintenance was found to be associated with physical activity, intake of > 5 daily servings of fruit and vegetables, and intake of < 2 daily servings of high-fat foods.

An earlier study conducted by Beerman et al⁵² that evaluated eating habits in a group of 152 undergraduate students enrolled in a basic nutrition class for non-majors at Washington State University also found significant differences between genders in eating habits. Forty-four percent of participants were male and 56% were female. Results showed that males and females significantly differed in their attitudes towards 10 of the 27 food items in the questionnaire ($P < 0.05$), where a higher proportion of males preferred sugar-sweetened drinks and bread compared to females, who preferred sugar-free drinks and whole grain breads ($P < 0.05$). In addition, men were found to be more likely to drink beer compared to females ($P < 0.05$).

The following studies showed a higher likelihood of male college students to gain weight compared to females. A study conducted on a small campus at the University of Utah in Salt Lake City, involved 125 freshmen living on campus, 84.8% were white and 66.4% were females.²¹ The study was part of the NCHA (National College Health Assessment) and collected self-reported height and weight data, and showed mean overall weight gain of 2.7 lb, with a significant overall increase of 0.4 in BMI ($P < 0.05$). Results further indicated a mean weight increase of 3.7 lb in men compared to 1.7 lb in women. However, the study did not examine factors that may have affected the weight change.

Brunt et al³⁰ reported male college students were 3 times more likely to be overweight than females (55% and 20% respectively, $P < 0.001$). In a separate article, Brunt and Rhee⁴⁴ suggested that a possible reason for higher males' weight compared to that of females is increased muscularity in males compared to females, a notion supported by a previous study by Racette et al²⁴ that showed men were more likely to partake in strength training exercises compared to women.

Cluskey and Grobe¹⁰ found that the proportion of heavy males who gained more than 5.07 lb (2.3 kg) was greater than that of heavy females (38% and 0.03% respectively) and the proportion of males who gained over 9.9 lb (4.5 kg) was higher compared to that of females (8% and 6% respectively).

By conducting chi square analysis, Kasparek et al²⁰ found a significant association between gender and BMI ($P = 0.035$) where more men than expected were classified as overweight ($P = 0.051$).

Lloyd-Richardson et al conducted 2 more studies to assess weight gain in college freshmen and during the first 2 years of college.²⁷ The authors studied freshman weight gain in 326 students in a Rhode Island private university where all students lived on campus and participants' height and weight were measured 3 times throughout freshman year. Over 60% of students were white or female. The authors discovered that average weight gain in females was significantly lower than that of males (3.5 lb and 5.5 lb respectively, $P < 0.01$). Over 70% of participants gained weight; the proportion of overweight students significantly increased from 11% to 13.5% and the proportion of obese students significantly increased from 3.7% to 4.3% ($P = 0.02$). The authors went

on to study weight gain through sophomore year in students at a public state university in Indiana, all of whom lived on campus. Sample sizes varied from 904 participants at baseline upon entering freshman year (54.6% males, 91.3% white) through 374 at the end of freshman year, to 494 at end of sophomore year. Mean weight gain by the end of freshman year was 7.7 lb (3.5 kg) for both males and females. However, where mean weight gain in females was significant during the first semester of freshman year at 7.5 lb (3.4 kg), mean weight gain in males was significant during both semesters at 7.04 lb (3.2 kg) in the first semester and 1.32 lb (0.6 kg) at the beginning of the second semester. Both males and females continued to increase in weight through the end of sophomore year where male total mean weight gain was 9.46 lb (4.3 kg) and female total mean weight gain was 9.24 lb (4.2 kg). The authors did not examine potential causes and behaviors that may have been associated with these weight changes.

Several studies further examining behavioral and attitudinal differences between the genders may suggest explanations to the differences in weight gain patterns between males and females. Levi et al⁵³ studied 358 students in the California State University, Chico and employed a validated 16-Item Food Decision Involvement Scale to assess students' level of involvement in making food choices. The tool rated the students' perceived significance of their choice, probability for an unfavorable choice, symbolic worth of the food choice, perceived attractiveness of the food, and how the student felt about his/her decision. Results indicated that 49% of females scored high on the level of involvement compared to 27.9% of males, and females valued food healthfulness, quality, appearance, taste, label information, and their own mood significantly higher

than males. In evaluation of BMI values, proportion of overweight males ($\text{BMI} \geq 25$) was higher than that of overweight females (28.5% vs. 13.5%) as well as proportion of obese males ($\text{BMI} \geq 30$) compared to females (6.3% vs. 1.0%). The authors suggested that gender differences in level of involvement might indicate gender stereotyping and social pressure as significant factors that contribute to certain dietary behaviors. The authors stated that since study questions did not investigate specific circumstances that may have affected students' food choices, such as time and place of consumed meals, further investigation is warranted.

The study by Levi et al⁵³ was further supported by a study conducted in London, which examined causes for avoidance of foods by college students and found distinct significant differences between male and female students in patterns of food choices.⁵⁴ The study involved 113 students and used 3 types of tools to assess patterns of food rejection. One tool was a validated Food Avoidance Inventory scale of 14 reasons for food avoidance rated on a Likert scale for weight, health, unnatural content, animal ethics, and "other". The second tool was a Disgust and Hedonic scale that evaluated attitudes and sensory value, respectively, of the avoided food. The third tool was a Restrained Eating Scale that evaluated the degree of restrained eating behavior. Results showed that males were mostly motivated by taste on all the avoided foods and tended to avoid mostly vegetables, whereas females were mostly concerned with weight and the food's fat and caloric content while stating that they actually liked the avoided food. Health concerns were not marked as strong motivators in either gender, and people of

both genders that avoided meat stated significantly stronger ethical reasons for avoidance of meat than for avoidance of other foods ($P < 0.05$ for males, and $P < 0.001$ for females).

Differences in weight gain between males and females may also be due to different approaches in their reaction to stressors such as the new college environment, newly found independence, and academic performance, as well as different attitudes towards body image and weight. One study that examined those differences analyzed data collected from 4 separate freshman populations spread across 4 consecutive freshman years.²⁵ For each freshman year the data were collected at baseline and end of that year. All participants were combined into a single sample of 396 participants that were 67% female and 73% white. Baseline information on weight and height was self-reported, whereas follow-up was measured. However, self-reported data were deemed reliable as it was correlated with measured data ($r = 0.997$, $P < 0.001$). Weight gain was significant at an average overall 5.3 lb ($P < 0.001$). Eighty percent of participants gained weight with non-significant differences between the genders and the proportion of overweight males increased from 11.5% to 16.5% compared to that of females that increased from 6.7% to 11%. The authors found that different factors were significantly correlated with weight change for the two genders. In males, increase in alcohol intake was significantly correlated with weight gain, whereas peer pressure, stress, and low intellectual confidence were significantly correlated with weight loss ($r = 0.181$, $P < 0.03$). On the other hand, in females, increase in workload was significantly correlated with weight gain and intake of 5 daily servings of fruit and vegetables was significantly correlated with weight loss ($r = 0.115$, $P < 0.02$). Additional significant differences

between the genders on causes of stress and attitudes towards life-changing events did not account for variability in weight change. The authors stated there might be more variables that need to be tested that were not addressed in their study.

A study of 116 college students of whom 62% were female⁴⁸ and that utilized a Health Risk Appraisal, also found behavioral and attitudinal differences between the genders. Although no significant predictors for male BMI increase were found, females who had an increase in BMI levels were more likely to exhibit behaviors such as alcohol and caffeine use and low fiber intake, and they also tended to lack adequate coping mechanisms. However, the authors claimed that correlations were not significant for the male population due to the small number of male participants (n=40).

Yet another study that evaluated possible predictors of freshman weight gain found significant differences between male and female first-year college students.²⁶ Researchers focused on 9 potential factors: disordered eating, exercise, negative attitude, body image, interpersonal concerns, alcohol and smoking, relationships with parents, healthy eating, and unhealthy eating. A total of 607 students were evaluated during senior year in high school and again during their first year in college (56% female, 75% white). Results indicated that although mean weight significantly increased for both men and women without significant difference between the genders (3.5 lb and 4.0 lb respectively, $P < 0.001$), the genders differed in predictors for weight gain: in men, exercise and relationship with parents were negatively associated with BMI change ($P < 0.05$); whereas in women, relationship with parents had a positive association with BMI change and was the only predictor for weight change ($P < 0.05$).

One study that involved 503 students in a private university in western United States compared diet quality of students on a prepaid meal plan with students that were not on a plan.⁵⁵ Results indicated that the effect of meal plan participation was significantly different between the genders. The intake of fruit and vegetables by males on a meal plan was significantly closer to Food Guide Pyramid recommendations compared to males who were not on a meal plan ($P < 0.01$), however female intake was not significantly different between those that were on a meal plan and those that were not. Based on observation, the authors suggested that the male tendency to have a high intake of French fries as part of their vegetable consumption was one possible explanation for the difference between the genders.

As described here, gender behavioral differences are numerous and significant, and although not all studies showed a significant association between weight gain and those behaviors and attitudes, further research into the differences between the genders may suggest additional clues. Because of these differences, an effective intervention to prevent weight gain should probably be designed differently for males and females.

Ethnicity. Ethnicity constitutes a reference group. Sociologically, ethnicity is defined as a group to which an individual identifies by way of experiences, views, cognition, self-perception, and attitudes.⁵⁶ An individual's perception of the reference group may influence behaviors including dietary and lifestyle behaviors.

The Theory of Planned Behavior is a basic conceptual framework model that explains the pathways to behavior performance. The pathways stem from attitudes based on several factors: the individual's beliefs about an anticipated outcome of a certain

behavior and the value of that outcome; subjective norms that are the individual's beliefs about behavioral expectations of others (e.g., family, friends, community), and motivation to comply with those expectations; perceived behavioral control that are the individual's beliefs about the presence of facilitating factors or barriers to a specific behavior, as well as their strength; and subsequent behavioral intentions that lead to actual behaviors. Since behavioral intentions are indicative of readiness for behavior performance, this theory is used as a predictive tool of behavior.⁵⁷

A study that employed the use of the Theory of Planned Behavior in the investigation of the role of group norms in the prediction of eating behaviors was conducted in Australia.⁵⁸ The study included 95 students that were evaluated in 2 sessions: during the first session, the students were administered a questionnaire, which collected information on planned behavior variables and behavioral intentions; during the second session, the students reported actual eating behaviors. Results indicated that all 3 variables of the Theory of Planned Behavior (attitudes, subjective norms, and perceived behavioral control) were significantly responsible for the variance in intentions ($P < 0.001$). More specifically, students that exhibited high identification with group norms demonstrated greater intention to conform to the group's healthy or unhealthy behavior ($P = 0.001$) compared to students that exhibited lower identification with group norms. However, some limitations that prevent generalization of results to other freshman populations include the fact that 80% of participants were female and they were all recruited from a pool of psychology classes.

DeBate et al⁴⁰ found that self-reported weight and weight gain of African-American college females were significantly higher compared to those of white college females ($P < 0.01$) and reported significantly lower meal frequency and late night snacking, and a higher frequency of fast-food intake compared to white students ($P < 0.05$). By contrast, white female students reported a significantly higher average intake of daily dairy servings and bread (1.92 and 2.79 respectively, $P < 0.05$) compared to that of African-American female students (1.24 and 1.89 respectively, $P < 0.05$).

Contrary to DeBate et al,⁴⁰ the Rich and Thomas⁵¹ study results indicated that ethnicity was not a factor in BMI change. Rich examined the effect of ethnicity on BMI change and perceived barriers to a healthful lifestyle in 210 female undergraduate college students that were recruited from psychology classes as part of a student health research project. Participants were 53% European-American, 28% African-American, and 19% Latina-American. African-Americans were found to have received more health and nutrition information from professionals compared to the European-Americans ($P < 0.05$), which may further enhance the effect of acquired knowledge on dietary behaviors, as discussed previously. Additionally, more European-Americans reported time as a significant barrier for a successful healthful lifestyle compared to African-Americans ($P < 0.05$), whereas other suggested barriers, such as motivation and money, were not significantly different between ethnicities. The authors suggested that additional research is warranted in testing additional reference group factors such as acculturation, peer and family effect, and socioeconomic background that may have skewed the results.

The following studies of the general population describe differences between ethnicities in measured and self-reported BMI values. The Third National Health and Nutrition Examination Survey (NHANES III), a cross-sectional survey conducted in 1988-1994, provided data for examination of the relationship between ethnicity and BMI.⁵⁹ Data were collected from interviews and examinations of individuals aged 2-months old and older with an over-sampling of Mexican-Americans and African-Americans across the United States by using a mobile examination center. The total sample size included 15,025 people over the age of 20. The main results indicated that self-reported data, when compared with measured data, was consistently lower among Mexican-Americans by up to 21%, suggesting that use of such data will be invalid for use in future research.

Truong and Sturm⁶⁰ analyzed self-reported height and weight data collected over a period of 17 years between 1986 and 2002 from 1,879,862 individuals across the United States, via the Behavior Risk Factor Surveillance System. This study found that non-Hispanic blacks had a faster increase in BMI of 2.79 compared to a BMI increase of 2.0 in non-Hispanic whites and 2.17 in Hispanics ($P < 0.001$).

According to the World Health Organization (WHO), and accepted by the U.S. National Institute of Health, classification of global BMI values for the general population that are used for identification of individuals at health risk are as follows: BMI values under 18.5 are classified as underweight, BMI values of 18.5 - 24.99 are considered as normal weight, BMI values of 25 - 29.99 are classified as overweight, and BMI values of 30 or higher are considered obese.⁶¹ However, due to recent research that

showed that Asians have a tendency for a higher percentage of body fat, as well as a considerable risk for type 2 diabetes and heart disease compared to the non-Asian population, even at BMI values below 25, WHO decided on different recommendations, based on risk of illness, for BMI classifications for the Asian population: individuals with BMI below 18.5 are classified as underweight, those with BMI values between 18.5 - 23 are considered at increased but an acceptable risk, those with BMI values between 23 - 27.5 are considered to be at an increased risk, and individuals with BMI of 27.5 and higher are considered to be at high risk. These classifications may not apply to actual weight change in the Asian freshman population but they imply that Asian-Americans that are overweight with BMI values greater than 23 may erroneously be considered of normal weight and may skew BMI distribution of the population.

There are considerable differences between ethnic populations in dietary preferences, traditions of involvement in food preparation, and genetic variance in body composition. Often there is a strong influence of group norms on the individual's behaviors and food choices. Therefore, treating the general population as a whole when studying weight gain or when tailoring interventions, without distinguishing between the various sub-populations, appears to be inappropriate.

Residence. Several studies showed a difference in lifestyle and subsequent weight gain between students living on campus and those living off campus. However, results have been contradictory. A study conducted by Hovell et al¹⁸ found an annual average weight gain of 8 lb in college freshman women living on campus compared to those living off campus that were of a similar socioeconomic background. Moreover,

during follow-up, the authors found that the rate of weight gain in on-campus students significantly dropped in sophomore year when students no longer lived on campus. However, the study was conducted over 20 years ago when the college environment might have been significantly different from today. Thus, factors associated with students' residence that may be affecting weight change may have changed since completion of the study. Nonetheless, the study suggested that differences exist between students living on campus and those living off campus and that further research was warranted.

Pliner and Saunders²³ have somewhat supported Hovell et al¹⁸ in their findings that residence was a valid factor in weight gain showing that BMI increase was significantly higher in students that lived on campus and practiced dietary restraint compared to their counterparts that lived off campus ($P < 0.01$). However, BMI changes of unrestrained eaters were not significantly different between on-campus and off-campus students suggesting that in this study residence was a factor in weight gain only in combination with dietary restraint. The authors examined diet quality by using an index score for "unhealthy eating" and discovered that scores of participants were not significantly different between students living on and off campus, implying that "unhealthy eating" is not related to residence. Since the dining facilities on the studied campus were not an all-you-can-eat buffet style cafeteria, and the "unhealthy eating" index tool was not validated, these results require further investigation of the effect of dining facilities and students' place of residence.

Contrary to Hovell et al¹⁸ and Pliner and Saunders,²³ in a study that investigated differences in dietary patterns among college students, Brunt et al³⁰ showed that off-campus students were significantly ($P < 0.05$) more likely to be overweight or obese compared to on-campus students (41% vs. 25%) and compared to students that lived with their parents (41% vs. 34%).

Since freshman students that reside on campus are often required to purchase a meal plan, it is of interest to compare diet quality of students on a meal plan with students that are not on a plan. In their study, Brown et al⁵⁵ evaluated diet quality based on the difference between the Food Guide Pyramid (FGP) recommended intake, and self-reported intake by students that were enrolled in an introductory nutrition course and were trained in assessing FGP serving sizes. Although participation in an on-campus meal plan was not restricted to on-campus student residents, 93 of the 94 students that were on a meal plan lived on-campus. Results indicated that students on a meal plan were more likely to meet FGP recommendations of fruit and meat ($P < 0.01$, $P < 0.05$ respectively) compared to students that were not on a meal plan. The authors suggested that the perceived high cost of fruit and meats for those that were not on a meal plan and a possible lack of knowledge in food preparation may have been contributors for the differences.

Results of the studies described here do not necessarily apply to the general college freshman population since not all college food venues are similar and not all offer the same varieties of foods. Therefore, when evaluating weight gain and residence, it would be advisable to assess tailored and specific interventions prior to implementation.

Validity of Self-Reported Data

Most studies showed that people tended to under-report their weight, for example the NHANES III⁵⁹ study, as described previously. Delinsky and Wilson¹⁵ also showed that self-reported values for BMI, as collected from a sub sample of 44 participants, were significantly lower than actual measurements by approximately half of a BMI point ($P = 0.008$).

A meta-analysis that examined accuracy of self-reported height and weight among adolescents⁶² further revealed that under reporting was most prevalent among overweight individuals with a wide range of error between -2.4% and -42.7% compared to normal weight individuals and among females compared to males.

Graham and Jones¹⁷ also showed a significant difference between self-reported and measured data in a study of a sample of 44 freshman college students that lived on campus and were 80% women. Researchers compared data obtained from campus Health Services with self-reported data, and evaluated initial weight and body fat with end-of-year weight and body fat. Results showed that there was a nonsignificant overall average weight loss of 1.5 lb compared to a significant increase of 4.1 lb in self-reported weight ($P < 0.01$) that was associated with initial expressed concern about the “Freshman 15” phenomenon [$F(4,39) = 2.72$, $P < 0.05$]. However, results of this study are weak since the sample was small and the data obtained from the Health Services was secondary. Thus, although the use of self-reported data may be inaccurate, it is convenient and reasonable in studies of weight change when data are compared between 2 time points.

In conclusion, although many studies have investigated freshman weight gain, the phenomenon deserves further examination with respect to the roles of gender, ethnicity, residence, initial BMI and freshman lifestyle perceptions.

CHAPTER 2

JOURNAL ARTICLE

FACTORS IN BMI INCREASE AMONG MULTICULTURAL FRESHMEN

ABSTRACT

Objectives: To examine BMI changes in multicultural freshmen attending a large public urban university, to explore factors associated with their BMI increase, and to investigate behavior changes and perceptions related to diet and body weight. *Methods:* Online surveys assessed ethnicity, residence, gender, BMI, daily intake of fruit and vegetables, meal frequency, and physical activity during Fall and Spring semesters (N = 337). *Results:* BMI increased significantly in Caucasians, on-campus students, and males. Decreased vegetable intakes were associated with BMI increase of less than one (P < 0.05). *Conclusions:* Freshman weight gain may be a function of ethnicity, residence, and gender.

Key words: freshmen, weight-gain, ethnicity, residence, gender.

INTRODUCTION

The prevalence of overweight (body mass index [BMI] ≥ 25 - 29.9 kg/m²) and obesity (BMI ≥ 30) has increased significantly in the United States over the past 20 years.¹⁻⁴ Currently, over two-thirds of adult Americans aged 20 to 74 are overweight,⁴ and have an increased risk of chronic diseases, such as type 2 diabetes, hypertension, cardiovascular disease, and some cancers.⁵⁻⁶ Treatment of obesity and associated morbidities is often difficult and expensive,⁷ thus making prevention of weight gain critical. Since adult obesity is associated with late-adolescent obesity,⁸ understanding the factors leading to weight gain during adolescence is necessary.

The transition from adolescence to adulthood during the freshman year in college is often marked by newfound independence, newly adopted lifestyles and subsequent

weight gain, reported as early as the first semester of college.⁹⁻¹³ In some cases, weight gain continues throughout the entire freshman year.¹⁴⁻²⁸ This phenomenon is known in the popular media as “The Freshman 15,”^{9,17} because of the assumption that 15 lb are gained by students in the first year of college. However, in peer-reviewed studies, the weight gain has been reported to be less than this, at between 1.5 and 5.5 lb.⁹⁻²⁹ In these studies, methodological problems, including small sample sizes, lack of gender and ethnic diversity, and limited examination of residence limit generalizability to diverse student populations, make it important to examine the role of gender, ethnicity, and residence in weight change.

Studies attempting to explain weight gain in freshmen have examined behaviors relating to diet and exercise. For example, weight gain has been associated with consumption of fewer fruit and vegetables,²³ and physical activity appears to predict weight change in freshmen.^{14,16,19} Definitive reasons for freshman weight gain are lacking.

The objectives of this study were 1) to examine BMI changes in multicultural male and female freshmen, living on and off campus, attending a large, urban university, 2) to identify dietary and exercise behaviors that may be associated with BMI increase in this population (while controlling for initial BMI classification), and 3) to explore perceptions and attitudes related to diet, nutrition, and body weight, and their association with BMI classification and residence status.

METHODS

Research Design

The 6-month longitudinal study collected pretest and posttest data using two online surveys (www.SurveyMonkey.com, Portland OR). The survey was piloted to a group of ethnically diverse nutrition students attending the same university to determine readability, understanding, and ease of administration. The Institutional Review Board for Human Subjects at San Jose State University approved the research protocol. Students provided informed consent prior to survey access.

Subject Recruitment

Participants of the fall survey conducted in early November 2007 were recruited from 3,260 first-time freshman students that included 1,552 students living on campus and 1,708 students living off campus. Recruitment was done via intercampus mail sent to all on-campus residents, U.S. mail sent to 45% of off-campus residents that were randomly selected, and emails sent to all students through the university messaging system and SurveyMonkey. All recruitment efforts directed students to the online survey. Participants who completed surveys were entered a drawing for 1 of ten \$25 gift cards for use at various venues on campus.

Recruitment for the follow-up Spring survey conducted in April 2008, was via emails sent through SurveyMonkey to participants of the Fall survey. Recruitment continued over a period of 3 weeks through which the survey was available online. During the first 2 weeks, participants were entered into a drawing for 1 of two \$10 gift certificates each week. At the end of 3 weeks, all participants entered 2 additional

drawings for 1 of two \$10 gift certificates and for 1 of five \$50 gift certificates or an iPod Shuffle.

Survey Design and Measures

In addition to collecting demographic information (ethnicity, residence and gender) the survey used multiple choice questions to assess factors previously reported to be associated with weight gain such as meal frequencies, and daily intake of fruit and vegetables and physical activity patterns. It also assessed past and present practices of dietary restraint and perceived change of own diet during freshman year.

Weekly breakfast lunch and dinner meal frequencies were rated on a scale of 0 to 3 (0 = none, 1 = 1 to 3 times per week, 2 = 4 to 6 times per week, 3 = daily), and daily intake of fruit vegetables, and other vegetables, defined as vegetable juice or vegetables that are cooked in soup, stew, stir fry or other dishes were rated on a scale of 0 to 3 (0 = none, 1 = 1 daily serving, 2 = 2 daily servings, 3 = ≥ 3 daily servings). Definitions for daily servings of fruit and vegetables based on USDA guidelines were given at the beginning of each question. Patterns of physical activity were recorded by reported weekly frequencies of listed moderate and vigorous physical activities as defined by USDA, and the total average number of minutes spent on each activity. The survey used 5-point Likert scale questions to assess students' perceptions of diet, fruit and vegetables, and own body weight. Self-reported height (in) and weight (lbs) were used to calculate body mass index ($BMI = \text{lbs} \times 703/\text{in}^2$).

Data Analysis

Based on CDC definitions, all participants were categorized as underweight, normal weight, overweight or obese.²⁹ The initial BMI classifications obtained in the Fall survey are referred to as “initial BMI” (iBMI) and the classifications obtained from the Spring survey are referred to as “Spring BMI.” Students who completed both Fall and Spring surveys were classified as “completers” and were categorized into 4 BMI change groups: 1) “Lost”, whose BMI decreased; 2) “Same”, whose BMI did not change; 3) “Gained <1” who had a BMI increase of <1; and 4) “Gained >1” who had a BMI increase of at least 1.

Reported physical activity patterns were assigned specified scores based on the Godin Leisure Time Questionnaire.³⁰ The reported number of weekly minutes spent performing a specific activity were converted into weekly METs (Metabolic Equivalent Time) according to intensity of activity, where total reported weekly hours spent doing moderate physical activity were multiplied by 4, and total reported weekly hours spent doing vigorous physical activity were multiplied by 7. The 2 scores were then summed to arrive at a total MET score that represented the level of physical activity.

Statistical analysis was conducted using SPSS 16.0 for Mac (Chicago, IL) and comprised descriptive and inferential statistics. One-way ANOVA was used for analysis of characteristic differences between completers and non-completers to determine whether ethnicity, residence, gender, and iBMI were factors in BMI change, and to determine whether ethnicity, residence, gender and iBMI change were factors in behavior changes. Paired-t tests were used to analyze BMI and behavioral differences between

Fall and Spring. Pearson's chi square tests were used to analyze the Likert scale questions for relationships between BMI change, dietary restraint, and perceived change in diet; between BMI category and perceptions of diet, fruit and vegetables, and body weight, and between residence and perceptions of fruit and vegetables. Level of significance was set at $P < 0.05$. Results were reported as means $\pm$ standard deviation.

RESULTS

Participants

The Fall sample contained 761 respondents who provided information about height, weight, ethnicity, residence, and gender. The Spring sample included 337 respondents. Surveys from respondents who provided duplicate entries, whose BMI change was > 6 , who failed to report height or weight, and who reported "shrinking" in height by > 1 in were discarded.

Completers and non-completers significantly differed in their ethnic distribution [$F(1,759) = 8.41, P = 0.004$]. Asians constituted the highest proportion among completers (40%). Attrition of Asians was 50%, Caucasians 52%, and Hispanics 64% (Table 1).

Table 1 Participants' Baseline Characteristics			
	Fall % (n)	Non Completers % (n)	Completers % (n)
Gender			
Male	39(299)	41(173)	37(126)
Female	61(462)	59(251)	63(211)
Ethnicity*			
Caucasian	29(220)	27(115)	31(105)
Asian	36(276)	33(139)	41(137)
Hispanic	16(122)	18(78)	13(44)
Other	19(143)	22(92)	15(51)
Residence			
On Campus	54(408)	56(236)	51(172)
Off Campus	46(353)	44(188)	49(165)
iBMI Category			
Under Weight <18.5	7(55)	7(29)	8(26)
Normal Weight 18.51-24.99	67(511)	68(288)	66(223)
Over Weight 25-29.99	19(140)	16(70)	21(70)
Obese ≥30	7(55)	9(37)	5(18)
Total	100(761)	100(424)	100(337)
Note.			
* P < 0.05			

BMI Change

Overall, mean BMI significantly increased by 0.15 ± 1.13 [$t(336) = 2.35$, $P < 0.05$] (Table 2). Approximately 40% of participants exhibited a BMI increase in their freshman year, with 2% of participants shifting from a normal weight BMI classification to an overweight BMI classification.

Gender and iBMI were each significant factors in the change of BMI [$F(1,335) = 3.88$, $P = 0.05$; $F(3,333) = 2.89$, $P = 0.04$ respectively], however neither ethnicity nor residence were factors. Mean BMI change was statistically significant in males [$t(125) = 3.62$, $P < 0.01$]; in on-campus students [$t(171) = 2.31$, $P < 0.05$]; in Caucasians [$t(104) = 2.25$, $P < 0.05$]; in students of underweight iBMI [$t(25) = 2.63$, $P < 0.05$]; and in students of normal weight iBMI [$t(222) = 3.99$, $P < 0.01$]. BMI increase among Hispanics was the highest at 0.35 ± 1.54 but statistically not significant (Table 2).

Table 2 BMI Changes Fall to Spring								
	Mean BMI Change			Lost	Same	Gained<1	Gained>1	Total
	Fall	Spring	Change	%(n)	%(n)	%(n)	%(n)	%(n)
All	23.12 $\pm$ 4.22	23.27 $\pm$ 4.32	0.15 $\pm$ 1.13*	27(92)	33(110)	27(92)	13(43)	100(337)
Gender								
Male	23.25 $\pm$ 4.25	23.55 $\pm$ 4.27	0.30 $\pm$ 0.94*	28(26)	39(43)	40(37)	47(20)	37(126)
Female	23.04 $\pm$ 4.21	23.09 $\pm$ 4.35	0.05 $\pm$ 1.22	72(66)	61(67)	60(55)	53(23)	63(211)
Ethnicity								
Caucasian	22.92 $\pm$ 3.59	23.16 $\pm$ 3.61	0.24 $\pm$ 1.1*	30(28)	33(36)	27(25)	37(16)	31(105)
Asian	22.95 $\pm$ 4.52	23.03 $\pm$ 4.47	0.09 $\pm$ 1.03	37(34)	47(52)	39(36)	35(15)	41(137)
Hispanic	24.65 $\pm$ 5	25 $\pm$ 5.8	0.35 $\pm$ 1.54	13(12)	9(10)	15(14)	19(8)	13(44)
Other	22.68 $\pm$ 3.64	22.6 $\pm$ 3.45	-0.08 $\pm$ 1.02	20(18)	11(12)	19(17)	9(4)	15(51)
Residence								
On campus	23.09 $\pm$ 4.07	23.29 $\pm$ 4.2	0.2 $\pm$ 1.16*	48(44)	51(56)	52(48)	56(24)	51(172)
Off campus	23.15 $\pm$ 4.39	23.23 $\pm$ 4.46	0.08 $\pm$ 1.1	52(48)	49(54)	48(44)	44(19)	49(165)
iBMI Category								
Underwt <18.5	17.81 $\pm$ 0.67	18.07 $\pm$ 0.81	0.26 $\pm$ 0.1*	3(3)	11(12)	10(9)	5(2)	8(26)
Normal 18.51-24.99	21.58 $\pm$ 1.7	21.82 $\pm$ 1.95	0.24 $\pm$ 0.89*	59(54)	66(73)	73(67)	67(29)	66(223)
Overwt 25-29.99	26.88 $\pm$ 1.46	26.67 $\pm$ 1.9	-0.21 $\pm$ 1.34	28(26)	19(21)	17(16)	16(7)	21(70)
Obese >30	35.25 $\pm$ 4.09	35.44 $\pm$ 5.49	0.19 $\pm$ 2.59	10(9)	4(4)	-	12(5)	5(18)
Note. Lost = BMI decrease Same = No Change in BMI Gained<1 = BMI increase < 1 Gained>1 = BMI increase > 1 * $P < 0.05$								

Changes in Behaviors

Four BMI change groups significantly differed from each other in intake of daily servings of other vegetables [$F(3,318) = 3.13$, $P < 0.05$] and in daily intake of total vegetables [$F(3,313) = 4.21$, $P < 0.01$]. Paired-t tests for those behaviors in Fall and Spring revealed that the “Gained<1” group had a statistically significant decrease in daily intake of other vegetables by $0.27 \pm .99$ [$t(85) = -3.56$, $P < 0.05$] and in daily intake of total vegetables by 0.54 ± 1.39 [$t(85) = -3.56$, $P < 0.01$] (Table 3A).

Table 3A				
Behavior Changes by BMI Change				
Behavior	Lost	Same	Gained<1	Gained>1
Daily Other Vegetable Intake				
Fall	0.83 ± 0.75	0.84 ± 0.85	1.12 ± 0.93	0.85 ± 0.9
Spring	0.76 ± 0.68	0.87 ± 0.74	0.85 ± 0.82	1.08 ± 0.87
Change	-0.07 ± 0.84	0.03 ± 0.93	$-0.27 \pm 0.99^*$	0.23 ± 0.99
Total Daily Vegetable Intake				
Fall	2.21 ± 1.23	2.2 ± 1.47	2.55 ± 1.64	2.28 ± 1.73
Spring	2.16 ± 1.18	2.17 ± 1.34	2.01 ± 1.42	2.67 ± 1.59
Change	-0.05 ± 1.31	-0.03 ± 1.61	$-0.54 \pm 1.39^*$	0.39 ± 1.31
Note * $P < 0.05$				

Ethnic groups significantly differed from each other in intake of other vegetables and total vegetables [$F(3,318) = 3.26$, $P = 0.022$; $F(3,313) = 3.17$, $P = 0.025$ respectively] and in moderate METs [$F(3,272) = 3.96$, $P = 0.009$]. Paired-t tests of these behaviors in Fall and Spring by ethnicity revealed a significant decrease in Asians’ mean daily intake

of other vegetables by 0.2 ± 0.93 [$t(127) = -2.46$, $P = 0.015$] and in Others mean daily intake of total vegetables by 0.53 ± 1.63 [$t(46) = -2.24$, $P = 0.03$]. Others had a significant increase of 6.72 ± 15.23 in mean total weekly METs [$t(42) = 2.89$, $P = 0.006$] (Table 3B).

Table 3B.				
Behavior Changes by Ethnicity				
Behavior	Caucasian	Asian	Hispanic	Other
Daily Other Vegetable Intake				
Fall	0.63 ± 0.71	1.18 ± 0.9	0.81 ± 0.8	0.92 ± 0.89
Spring	0.79 ± 0.71	0.98 ± 0.79	0.83 ± 0.82	0.73 ± 0.76
Change	0.16 ± 0.86	$-0.2 \pm 0.93^*$	0.02 ± 0.95	-0.18 ± 1.03
Total Daily Vegetable Intake				
Fall	1.93 ± 1.22	2.67 ± 1.57	2 ± 1.54	2.4 ± 1.58
Spring	2.12 ± 1.22	2.43 ± 1.42	1.98 ± 1.56	1.87 ± 1.26
Change	0.18 ± 1.28	-0.24 ± 1.48	-0.03 ± 1.51	$-0.53 \pm 1.63^*$
Moderate Weekly METs				
Fall	9.34 ± 9.87	8.97 ± 11.78	9.67 ± 12.44	8.73 ± 10.99
Spring	9.12 ± 10.72	9.97 ± 10.9	8.78 ± 8.19	15.45 ± 19.6
Change	-0.22 ± 10.33	1.01 ± 11.06	-0.88 ± 11.88	$6.72 \pm 15.23^*$
Note				
* $P < 0.05$				

The two residence groups differed significantly from each other in weekly dinner frequencies [$F(1,286) = 4.57$, $P = 0.033$], moderate METs [$F(1,274) = 4.31$, $P = 0.039$], vigorous METs [$F(1,248) = 6.67$, $P = 0.01$] and total METs [$F(1,235) = 7.99$, $P = 0.005$]. Paired-t tests of those behaviors in Fall and Spring by residence revealed that in students living on campus mean weekly dinner frequency had a statistically significant increase of

0.17 ± 0.68 [t(148) = 0, P = 0.003] and students living off campus had a significant increase in mean moderate METs by 2.82 ± 12 [t(133) = 2.72, P = 0.007], in mean vigorous METs by 4.88 ± 18.77 [t(123) = 2.9, P = 0.004] and in mean total METs by 8.27 ± 25.41 [t(118) = 3.55, P = 0.001] (Table 3C).

Table 3C.		
Behavior Changes by Residence		
Behavior	On Campus	Off Campus
Dinner Weekly Frequency		
Fall	2.48 ± 0.71	2.62 ± 0.66
Spring	2.64 ± 0.59	2.62 ± 0.62
Change	0.17 ± 0.68*	0.00 ± 0.65
Moderate Weekly METs		
Fall	10.39 ± 11.57	7.79 ± 10.55
Spring	10.26 ± 10.26	10.6 ± 14.49
Change	-0.14 ± 11.64	2.82 ± 11.99*
Vigorous Weekly METs		
Fall	18.48 ± 30.59	10.21 ± 20.27
Spring	16.22 ± 23.19	15.09 ± 22.91
Change	-0.26 ± 24.54	4.88 ± 18.77*
Total Weekly METs		
Fall	28.68 ± 39.6	16.54 ± 28.55
Spring	26.47 ± 30.48	24.8 ± 32.48
Change	-2.2 ± 31.32	8.27 ± 25.42*
Note		
* P < 0.05		

Males and females significantly differed from each other in intake of vegetables and in total METs [F(1,319) = 5, P = 0.026; F(1,235) = 4.52, P = 0.035 respectively]. A

paired-t test of those behaviors in Fall and Spring by gender revealed that mean daily intake of vegetables in females significantly decreased by 0.14 ± 0.79 [$t(198) = -2.4$, $P = 0.016$] and mean total METs in males had a statistically significant increase of 8.03 ± 34.14 [$t(91) = 2.26$, $P = 0.026$] compared to that of females (Table 3D).

Table 3D.		
Behavior Changes by Gender		
Behavior	Male	Female
Daily Other Vegetable Intake		
Fall	1.26 ± 0.78	1.47 ± 0.87
Spring	1.34 ± 0.86	1.33 ± 0.81
Change	0.07 ± 0.85	$-0.14 \pm 0.79^*$
Total Weekly METs		
Fall	28.29 ± 42.36	18.96 ± 28.89
Spring	36.32 ± 38.86	18.86 ± 23.38
Change	$8.03 \pm 34.14^*$	-0.1 ± 24.67
Note		
* $P < 0.05$		

The 4 iBMI groups significantly differed from each other in daily vegetable intake [$F(3,317) = 3.61$, $P = 0.014$] in total daily vegetable intake [$F(3,313) = 3.42$, $P = 0.018$] and in weekly lunch frequency [$F(3,285) = 4.95$, $P = 0.002$]. Paired-t tests of those behaviors in Fall and Spring by iBMI revealed that in the normal weight iBMI group mean weekly frequency of lunch had a significant increase of 0.26 ± 0.78 [$t(192) = 4.61$, $P < 0.01$], while in the overweight iBMI group mean daily intake of total vegetables had a significant decrease of 0.46 ± 1.72 [$t(66) = -2.21$, $P = 0.03$]. Members of the obese iBMI group had a significant increase in mean daily intake of total vegetables by 0.75 ± 1.39

[$t(15) = 2.16$, $P = 0.05$] and in mean weekly frequency of lunch by 0.71 ± 0.83 [$t(13) = 3.24$, $P = 0.006$] (Table 3E).

Table 3E.				
Behavior Changes by iBMI				
Behavior	Under Weight	Normal Weight	Over Weight	Obese
Daily Other Vegetable Intake				
Fall	1.62 ± 0.90	1.33 ± 0.81	1.60 ± 0.87	0.94 ± 0.77
Spring	1.38 ± 0.75	1.29 ± 0.80	1.29 ± 0.80	1.44 ± 0.96
Change	-0.23 ± 0.71	-0.03 ± 0.74	-0.19 ± 0.1	0.5 ± 0.97
Total Daily Vegetable Intake				
Fall	2.54 ± 1.77	2.21 ± 1.46	2.67 ± 2.48	1.62 ± 1.26
Spring	2.27 ± 1.49	2.15 ± 1.3	2.21 ± 1.51	2.38 ± 1.46
Change	-0.27 ± 1.51	-0.06 ± 1.34	$-0.46 \pm 1.72^*$	
Lunch Weekly Frequency				
Fall	2.68 ± 0.48	2.19 ± 0.84	2.15 ± 0.86	1.86 ± 0.77
Spring	2.41 ± 0.67	2.45 ± 0.68	2.35 ± 0.78	2.57 ± 0.51
Change	-0.27 ± 0.63	$0.26 \pm 0.78^*$	0.2 ± 0.82	
Note				
* $P < 0.05$				

Perceptions of Diet, Intake of Fruit and Vegetables, and Own Body Weight

BMI change was associated with perceived change in diet during Spring [$\chi^2(6) = 1.40$, $P = 0.03$] where own diet was perceived as worse since Fall semester by 28% ($n = 35$) of respondents from the “Gained<1” and “Gained>1” groups combined compared to 13% ($n = 11$) of respondents from the “Lost” group and 23% ($n = 24$) of respondents from the “Same” group (Results not shown).

A significant association was found between the Spring BMI category and perceived importance of diet [$\chi^2 (12) = 2.37, P = 0.023$] where 50% of obese respondents (n = 8) compared to 87% of underweight respondents (n = 20), 78% of normal weight respondents (n = 162) and 82% of overweight respondents (n = 59) perceived their diet as important or extremely important to them (Table 4).

Table 4 Perceptions of Fruit and Vegetables, Diet, and Body Weight by BMI Categories				
Perception (Likert Scale Question)	Under Weight % (n)	Normal Weight % (n)	Over Weight % (n)	Obese % (n)
"What I eat is important/extremely important to me" *	27 (20/23)	78 (162/208)	82 (59/72)	50 (8/16)
"I agree that fruit and vegetables help me lose/maintain weight" *	55 (12/22)	61 (123/201)	69 (48/70)	63 (10/16)
"Best describe own body weight" *	54 (14/26)	76 (164/216)	71 (53/75)	89 (16/18)
"I am satisfied/very satisfied with own body weight" *	36 (8/22)	39 (79/201)	14 (10/70)	6 (1/16)
"My body weight is important/extremely important to me"	87 (20/23)	77 (159/207)	85 (61/72)	81 (13/16)
"I agree/strongly agree that eating fruit and vegetables is good for my health"	100 (22/22)	92 (187/204)	87 (60/69)	81 (13/16)
"I agree/strongly agree that if cost of fruit and vegetables were lower, I would eat more fruit and vegetables"	50 (11/22)	66 (131/200)	67 (47/70)	73 (11/15)
"I agree/strongly agree that my intake of fruit and vegetables depends upon availability on campus"	61 (14/23)	52 (109/210)	57 (42/73)	44 (7/16)
"It is likely/extremely likely that if there were a greater variety of fruit and vegetables on campus, I would eat more fruit and vegetables"	62 (13/21)	66 (132/199)	70 (48/69)	69 (11/16)
Note * P < 0.05				

Spring BMI category was associated with perceived role of fruit and vegetables in weight loss or in weight maintenance [$\chi^2(9) = 2.25, P = 0.007$] where 69% (n = 48) of the overweight respondents compared to 55% (n = 12) of the underweight respondents agreed that fruit and vegetables helped them lose or maintain weight (Table 4).

A significant relationship was found between Spring BMI category and self-perception of own body weight [$\chi^2(6) = 1.71, P < 0.01$] where 54% (n = 14) of the underweight respondents viewed themselves as underweight, 76% (n = 164) of the normal weight respondents viewed themselves as the right weight, 71% (n = 53) of the overweight respondents and 89% (n = 16) of the obese respondents viewed themselves as overweight (Table 4).

BMI category was associated with level of satisfaction with own body weight [$\chi^2(12) = 3.98, P < 0.01$] where 6% (n = 1) of the obese Spring BMI respondents were satisfied with own body weight compared to 39% (n = 79) of the normal weight respondents, 36% (n = 8) of the underweight respondents, and 14% (n = 10) of the overweight respondents (Table 4).

No relationships were found between Spring BMI category and the perception of fruit and vegetables as healthful foods, the perceived intake of fruit and vegetables as a function of their cost, their availability or their variety on campus, or the perceived stated importance of own body weight. Ninety one percent (n = 282) of participants agreed that fruit and vegetables are healthful foods, 65% (n = 200) agreed that if cost on campus were lower they would eat more fruit and vegetables, 53% (n = 172) agreed that their intake of fruit and vegetables depended on their availability on campus, 67% (n = 204)

stated that they thought it likely that they would eat more fruit and vegetables if variety on campus were greater, and 80% (n = 253) stated that their body weight was important to them (Table 4).

A significant relationship was found between place of residence and the perceived intake of fruit and vegetables as dependent upon variety or availability on campus [χ^2 (4) = 3.77, $P < 0.01$; χ^2 (4) = 8.98, $P < 0.01$ respectively] where 82% (n = 128) of on-campus respondents compared to 51% (n = 76) of off-campus respondents were likely to increase intake of fruit and vegetables if the variety on campus were greater. Additionally, 78% (n = 128) of on-campus respondents compared to 28% (n = 44) of off-campus respondents agreed that their intake of fruit and vegetables would increase if availability on campus were greater (Table 5).

Overall, 52.7% of participants in the Fall and 51.1% of participants in the Spring had an intake of at least 5 daily servings of fruit and vegetables.

Table 5 Perceptions of Fruit and Vegetables by Residence			
Perception Scale Question)	(Likert	On Campus % (n)	Off Campus % (n)
"It is likely/extremely likely that if there were a greater variety of fruit and vegetables on campus, I would eat more fruit and vegetables"		82 (128/157)	51 (76/148)
"I agree/strongly agree that my intake of fruit and vegetables depends upon availability on campus"		78 (128/165)	28 (44/157)
Note * $P < 0.05$			

Dietary Restraint

Overall, 68% of Fall respondents (n = 230) and 67% of Spring respondents (n = 226) reported never being on a diet. The proportion of respondents who reported currently being on a diet increased from 10% in the fall (n = 34) to 17% in the spring (n = 58). Chi square analysis revealed no relationship between BMI change and past or present practice of dietary restraint (Results are not shown).

DISCUSSION

Previous peer-reviewed studies that examined “Freshman 15” phenomenon reported weight gain between 1.5 and 5.5 lb.⁹⁻²⁹ This study showed an overall BMI increase of 0.15, which corresponds to approximately 1 lb, slightly lower than previous reports. A possible cause for the difference could be that Fall data were recorded late in the semester (during October-November); if data had been collected at the beginning of the semester, differences in BMI values may have been larger.

Ethnicity

While attrition of Asians and Caucasians was approximately 50% each, attrition of Hispanics who had the highest increase in BMI (0.35 ± 1.54 , $P = \text{n.s.}$) was 64%. Hispanics had the lowest representation with only 13% among completers (n = 44). On the other hand, Asians who had no significant BMI change were the largest ethnic group among completers (41%), suggesting that results of overall BMI increase may have been downward skewed and that insignificance of BMI increase among Hispanics may have been due to their low representation among completers.

Although Caucasians had a significant increase in BMI compared to other ethnicities (0.24 ± 1.1 , $P < 0.05$), ethnicity was not found to be significant factor in BMI change. Examination of differences in behavior changes between ethnicities showed that Asians had a significant decrease in intake of other vegetables compared to the other ethnicities, which may suggest that their total intake had decreased leading to their insignificant BMI change. However, since 15% of the population was classified as “Others,” (a mix of ethnicities), the results provided limited information on ethnic differences and thus represent a limitation in this study. Additionally, the limited number of assessed behaviors used in this study may suggest that the ethnic groups may have differed in other behaviors that were not explored here, particularly since several previous studies have shown differences in dietary behaviors between ethnicities.³¹⁻³³

Residence

Place of residence was not a significant factor in BMI change. However, pre and posttest comparisons of BMI showed that BMI significantly increased among students living on campus compared to those living off campus. Students living on campus had a significant increase in weekly dinner frequency compared to students living off campus, and students living off campus showed a significant increase in METs scores compared to those living on campus. These results suggest that students residing on campus who have easier access to dinner at the all-you-can-eat on-campus dining facility may consume more calories and that students residing off campus may have better access to opportunities for physical exercise. Contrary to results of this study, Beerman et al³⁴ reported that students living on campus had a higher intake of fruit and vegetables

compared to students living elsewhere, suggesting that dining at an on-campus dining facility contributed towards a healthful diet possibly due to convenience and professional meal planning. Additionally, Brunt and Rhee³⁵ further supported Beerman in showing that students living on campus have a higher intake of fruit vegetables compared to those living off campus. Brunt and Rhee also showed that off-campus students were more likely to be overweight or obese and to have a higher caloric intake compared to on-campus students. Brown et al³⁶ further supported Beerman's and Brunt's findings in showing that on-campus students were more likely to meet the Food Guide Pyramid recommendations for intake of fruit and vegetables. However, none of the three studies examined ethnic differences, Brunt's and Brown's studies evaluated college students of all years, and 85% of participants in Brown's study were females.

Eating at an on-campus all-you-can-eat facility as a factor in weight increase was suggested by Levitsky et al¹³ who found that consumption of breakfast and lunch at an all-you-can-eat facility accounted for 10% of the total variance in freshman weight gain. Levitsky suggested that portion sizes are larger at such facilities, and that such facilities should be held accountable for over consumption. However, Levitsky's study did not adequately evaluate physical activity and participants were recruited from a course related to nutrition.

Inconsistencies in studies' findings related to the effect residence on BMI and eating habits may be a function of variability in campus dining facilities.

Gender

Results of this study indicated that gender was a significant factor in BMI change and that males had a significant increase in BMI compared to females. Females showed a significant decrease in consumption of other vegetables compared to males, which may suggest a decrease in total intake. Additionally, their level of exercise did not change, which may explain the insignificant BMI change. Males had a significant increase in total METs compared to females suggesting that males' significant increase in BMI may have been due in part to an increase in muscle mass, which was not evaluated in this study and may be considered a limitation and should be examined in future research. Gender differences in dietary and physical activity behaviors were also shown in previous studies where males were more likely to gain weight compared to females.^{10,20,27,36,37} Several studies suggest possible grounds for the weight difference between the genders. Lowry et al³⁷ found that female college students were more likely than males to perceive themselves as overweight and less likely than males to partake in vigorous physical activity. Mooney and Walbourn³⁸ reported that when making food choices, females were more concerned with body weight and food calorie content compared to males who were more motivated by food taste. Levi et al³⁹ showed that college females were more influenced by food healthfulness, quality, appearance, taste, label information, and own mood compared to college males.

Initial BMI

In this study, initial BMI was found to be a factor in BMI change. BMI increase was significant for students initially classified as underweight (0.26 ± 0.1 , $P < 0.05$) and

for students initially classified as of normal weight (0.24 ± 0.89 , $P < 0.05$). Contrary to these findings, Kasperek et al²⁰ showed that weight gain in freshmen whose initial BMI was higher than 25 was approximately twice as high as that of freshmen whose initial BMI was lower than 25 ($P < 0.05$). However, Kasperek's evaluation of physical activity was incomplete and was based on the performance rate of vigorous activities only and the majority of participants in that study were white students who resided on campus. On the other hand, Mihalopoulos et al²¹ showed that students who had an initial BMI lower than 25 had a non-significant higher weight gain of 3.3 lbs on average compared to students who had an initial BMI higher than 25, whose weight gain was 0.8 lbs on average. However, the proportion of students in the various BMI classification groups may have been too small and therefore results were statistically non-significant. Edmonds et al¹⁶ showed that higher initial weight was a significant predictor of higher weight gain. However, Edmonds' study involved only freshman females, was 89% white, and collected the initial data prior to entering school.

Evaluation of differences in behavior changes between the 4 initial BMI groups showed that students of normal initial BMI had an increase in lunch frequency, which may have contributed to their BMI increase. Students of overweight initial BMI had a decrease in total daily vegetable intake, which may have been associated with a decrease in total intake leading to a non-significant decrease in BMI (-0.21 ± 1.34). Students of obese initial BMI had a significant increase in both lunch frequency and total vegetable intake leading to an increase in BMI (0.19 ± 2.59), which was non-significant possibly due to the small numbers in that group ($n = 18$). Students of underweight initial BMI did

not show significant changes in any of the behaviors measured. However, their intake may have increased in other food groups not measured in this study, such as fatty foods.

Behavior Change by BMI Change

The “Gained<1” group members showed a significant decrease in daily intake of vegetables compared to the other BMI change groups. Combined with the significant increase in BMI, these results may suggest a potential deterioration in healthful eating habits and a possible compensatory increase in intake from other food groups that may have caused the weight gain and that were not measured here. No significant changes were noted in those whose BMI increased by > 1 , possibly suggesting that dietary behaviors may have already been unfavorable to weight maintenance by the time the Fall survey was administered. These results are supported by the finding that BMI change was associated with perception of change in own diet where 28% ($n = 35$) of respondents from a combined “Gained<1” and “Gained>1” group reported their diet to be worse since the Fall semester compared to only 13% ($n = 11$) of respondents from the “Lost” group and 23% ($n = 24$) from the “Same” group.

Dietary Restraint

Results of this study showed that past or present dietary restraint was not associated with BMI change. These results are further supported by a study conducted by Pliner et al²³ that used a validated Restraint Scale in order to rate students as restrained or unrestrained eaters. The results also showed no relationship between BMI change and current or past practice of dietary restraint. Another study conducted by Delinsky and Wilson¹⁵ that involved first year college women showed that dietary restraint was

significantly greater in those that lost weight compared to others but that practice of dietary restraint did not predict weight change. These results were further supported by Lowe et al²⁸ that showed that dietary restraint in first year college women was not predictive of weight gain. However, Lowe's study included only 7 students that practiced dietary restraint.

Intake and Perception of Fruit and Vegetables

Frequencies of total daily intake of fruit and vegetables compared to the general recommendation of 5 per day showed that over half of participants had an intake of at least 5 daily servings of fruit and vegetables. These values are not consistent with previous studies that showed that most adolescents have lower than the recommended intake of total fruit and vegetables.⁴⁰⁻⁴¹ Additionally, 91% of participants agreed that fruit and vegetables are healthful foods and the majority of participants agreed that fruit and vegetables help them to lose or maintain their weight, with a higher proportion of overweight individuals agreeing to that statement (69%).

Possible barriers to a higher intake of fruit and vegetables were identified as availability, variety, and cost of fruit and vegetables on campus where a high proportion of participants both on and off campus agreed that if cost were lower and availability and variety on campus were higher, their intake of fruit and vegetables would likely be higher. Some of these concepts were associated with students' place of residence where a higher proportion of on-campus residents perceived availability, variety, and cost of fruit and vegetables on campus as barriers to a higher intake. However, the finding across the board that students perceived their intake of fruit and vegetables as dependent

upon the campus environment suggests that an on-campus intervention in providing a higher level of accessibility to fruit and vegetables may be a viable one.

Perceived Importance of Body Weight and Diet

Eighty percent of students of initial normal weight stated that their body weight was important or extremely important to them. Additionally, the majority of the underweight, normal weight and overweight students perceived their diet as important to them, suggesting that participants were self-selected and may have been biased towards a healthful lifestyle and improvement of eating habits. This notion may be further supported by the indicated high awareness of participants to their own body weight where students tended to correctly identify their body weight as underweight, overweight, or “just right.” Level of satisfaction with own body weight was low across the board where relatively low proportions of the populations ranging from 6% of the obese population to 39% of the normal weight population expressed satisfaction with their body weight. These results are supported by a previous study conducted by Vohs et al⁴² that suggested that body dissatisfaction is prevalent during college years.

Conclusion

The study had an advantage over previous studies that investigated the “Freshman 15” phenomenon in that contrary to most studies it involved a multicultural group of freshmen on a large urban campus, included 40% males, and comprised a comparable representation of on- and off-campus students. Additionally, the study involved a large number of participants and analyzed data based on students’ BMI rather than body

weight. This is important because BMI accounts for the continued growth in height of people in the student age group.⁴³

The use of self-reported data of height and weight may be interpreted as a limitation since previous studies showed that people tended to under-report their weight.^{15,44,45} However, its use is convenient and reasonable in studies of weight change particularly when data are compared between two time points.

Since weight gain has been associated with consumption of fewer fruit and vegetables,²³ increased intake of fruit and vegetables may help in preventing weight gain. This study suggested that an increase in intake of fruit and vegetables might be achieved by removal or decrease of the effect of identified barriers to their intake such as cost, availability and variety on campus. This study also showed that although Caucasians had a statistically significant increase in BMI, Hispanics had the highest BMI increase and the largest drop out rates, which suggested that this group might constitute a target group for an ethnically oriented future intervention.

In conclusion, this study showed that the college freshman population is not a homogenous group and that in order to effectively tailor future interventions further research should explore in more depth behavior and perception differences between students based on ethnicity, residence, gender, and initial BMI.

REFERENCES

1. Flegal KM. Trends in body weight and overweight in the US population. *Nutr Rev.* 1996;54:S97-100.
2. Flegal KM, Carroll MD, Kuczmarski RJ, et al. Overweight and obesity in the United States: prevalence and trends, 1960-1994. *Int J Obes Relat Metab Disord.* 1998;22:39-47.
3. Flegal KM, Carroll MD, Ogden CL, et al. Prevalence and trends in obesity among US adults, 1999-2000. *JAMA.* 2002;288:1723-1727.
4. Ogden CL, Carroll MD, Curtin LR, et al. Prevalence of overweight and obesity in the United States, 1999-2004. *JAMA.* 2006;295:1549-1555.
5. Pi-Sunyer FX. Medical hazards of obesity. *Ann Intern Med.* 1993;119:655-660.
6. National Institutes of Health. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: the evidence report. *Obes Res.* 1998;6 Suppl 2:51S-209S.
7. Finkelstein EA TJ, Cohen JW, Dietz, W. Annual medical spending attributable to obesity: payer- and service-specific estimates. *Health Aff.* 2009;28. w822-w831.
8. Whitaker RC, Wright JA, Pepe MS, et al. Predicting obesity in young adulthood from childhood and parental obesity. *N Engl J Med.* 1997;337:869-873.
9. Anderson DA, Shapiro JR, Lundgren JD. The freshman year of college as a critical period for weight gain: an initial evaluation. *Eat Behav.* 2003;4:363-367.
10. Cluskey M, Grobe D. College weight gain and behavior transitions: male and female differences. *J Am Diet Assoc.* 2009;109:325-329.
11. Hajhosseini L, Holmes, T, Mohamadid, P. Changes in body weight. *J Am Coll Nutr.* 2006;25:123-127.
12. Hoffman DJ, Policastro P, Quick V, et al. Changes in body weight and fat mass of men and women in the first year of college: a study of the "freshman 15". *J Am Coll Health.* 2006;55:41-45.
13. Levitsky DA, Halbmaier CA, Mrdjenovic G. The freshman weight gain: a model for the study of the epidemic of obesity. *Int J Obes Relat Metab Disord.* 2004;28:1435-1442.

14. Butler SM, Black DR, Blue CL, et al. Change in diet, physical activity, and body weight in female college freshman. *Am J Health Behav.* 2004;28:24-32.
15. Delinsky SS, Wilson GT. Weight gain, dietary restraint, and disordered eating in the freshman year of college. *Eat Behav.* 2008;9:82-90.
16. Edmonds MJ, Ferreira KJ, Nikiforuk EA, et al. Body weight and percent body fat increase during the transition from high school to university in females. *J Am Diet Assoc.* 2008;108:1033-1037.
17. Graham MA, Jones AL. Freshman 15: valid theory or harmful myth? *J Am Coll Health.* 2002;50:171-173.
18. Hovell MF, Mewborn CR, Randle Y, Fowler-Johnson S. Risk of excess weight gain in university women: a three-year community controlled analysis. *Addict Behav.* 1985;10:15-28.
19. Jung ME, Bray, SR, Ginis, KAM. Behavior change and the freshman 15: tracking physical activity and dietary patterns in 1st-year university women. *J Am Coll Health.* 2008;56:523-530.
20. Kasparek DG, Corwin S, Valois RF, et al. Selected health behaviors that influence college freshman weight gain. *J Am Coll Health.* 2008;56:437-444.
21. Mihalopoulos NL, Auinger P, Klein JD. The Freshman 15: is it real? *J Am Coll Health.* 2008;56:531-533.
22. Morrow M, Heesch KC, Dinger MK, et al Freshman 15: fact or fiction? *Obesity.* 2006;14:1438-1443.
23. Pliner P, Saunders T. Vulnerability to freshman weight gain as a function of dietary restraint and residence. *Physiol Behav.* 2008;93:76-82.
24. Racette SB, Deusinger SS, Strube MJ, et al. Weight changes, exercise, and dietary patterns during freshman and sophomore years of college. *J Am Coll Health.* 2005;53:245-251.
25. Economos CD, Hildebrandt ML, Hyatt RR. College freshman stress and weight change: differences by gender. *Am J Health Behav.* 2008;32:16-25.
26. Holm-Denoma JM, Joiner TE, Vohs KD, Heatherton TF. The "Freshman Fifteen" (the "Freshman Five" actually): predictors and possible explanations. *Health Psychol.* 2008;27:S3-S9.

27. Lloyd-Richardson EE, Bailey S, Fava JL, et al. A prospective study of weight gain during the college freshman and sophomore years. *Prev Med*. 2009;48:256-261.
28. Lowe MR, Annunziato RA, Markowitz JT, et al. Multiple types of dieting prospectively predict weight gain during the freshman year of college. *Appetite*. 2006;47:83-90.
29. Crombie AP, Ilich JZ, Dutton GR, et al. The freshman weight gain phenomenon revisited. *Nutr Rev*. 2009;67:83-94.
30. Godin G, Shephard RJ. A simple method to assess exercise behavior in the community. *Can J Appl Sport Sci*. 1985;10:141-146.
31. Louis W, Davies S, Smith J, et al. Pizza and pop and the student identity: the role of referent group norms in healthy and unhealthy eating. *J Soc Psychol*. 2007;147:57-74.
32. Truong KD, Sturm R. Weight gain trends across sociodemographic groups in the United States. *Am J Public Health*. 2005;95:1602-1606.
33. Debate RD, Topping M, Sargent RG. Racial and gender differences in weight status and dietary practices among college students. *Adolescence*. 2001;36:819-833.
34. Beerman KA, Jennings G, Crawford S. The effect of student residence on food choice. *J Am Coll Health*. 1990;38:215-220.
35. Brunt AR, Rhee YS. Obesity and lifestyle in US college students related to living arrangements. *Appetite*. 2008;51:615-621.
36. Brown LB, Dresen RK, Eggett DL. College students can benefit by participating in a prepaid meal plan. *J Am Diet Assoc*. 2005;105:445-448.
37. Lowry R, Galuska DA, Fulton JE, et al. Physical activity, food choice, and weight management goals and practices among US college students. *Am J Prev Med*. 2000;18:18-27.
38. Mooney KM, Walbourn L. When college students reject food: not just a matter of taste. *Appetite*. 2001;36:41-50.
39. Levi A, Chan KK, Pence D. Real men do not read labels: the effects of masculinity and involvement on college students' food decisions. *J Am Coll Health*. 2006;55:91-98.

40. Kimmons J, Gillespie C, Seymour J, et al. Fruit and vegetable intake among adolescents and adults in the United States: percentage meeting individualized recommendations. *Medscape J Med*. 2009;11:26.
41. Centers for Disease Control and Prevention. Youth risk behavior surveillance--United States, 2007. *MMWR*. 2008;57:1-131.
42. Vohs KD, Heatherton TF, Herrin M. Disordered eating and the transition to college: a prospective study. *Int J Eat Disord*. 2001;29:280-288.
43. Brown JE, Isacss JS, Krinke UB, et al. Adolescent Nutrition. In Brown JE, Isacss JS, Krinke UB, Murtaugh MA, Sharbaugh C, Stang J, Woolridge NH. *Nutrition Through The Life Cycle*. 2nd ed. Belmont, CA: Thomson Wadsworth 2005:328.
44. Gillum RF, Sempos CT. Ethnic variation in validity of classification of overweight and obesity using self-reported weight and height in American women and men: the Third National Health and Nutrition Examination Survey. *Nutr J*. 2005;4:27. doi: 10.1186/1475-2891-4-27.
45. Brunner Huber LR. Validity of self-reported height and weight in women of reproductive age. *Matern Child Health J*. 2007;11:137-144.

CHAPTER 3
SUMMARY AND REFERENCES

SUMMARY

Most studies that investigated freshman weight gain concluded that college freshmen gain between 1.5 - 5.5 lbs on average either during the first semester⁹⁻¹³ or throughout the entire freshman year.¹⁴⁻²⁸ Results of this study further support these findings of a relatively low weight gain during freshman year. Even though this reported increase in weight is lower than the purported 15 lbs, it is significant. It has previously been suggested that if weight gain becomes a trend that continues throughout the students' adult life, it may become considerable.⁶³ Therefore, evaluation of behaviors and perceptions among freshman that lead to weight gain, followed by appropriate interventions to prevent weight gain, is needed.

Since the majority of previous studies examining freshmen weight gain were limited in that they involved mostly females, Caucasians, and on-campus residents, results cannot be generalized to males, ethnically diverse populations, and those who live off campus.

As seen in previous studies, genders differ in attitudes towards food, exercise, and body image,^{10,20-21,25-27,30,42-44,48,52-55} which possibly lead to the observed differences in weight gain patterns, as seen in this study. However, since this study did not examine differences in body composition between the genders, further research is warranted.

Different ethnicities vary in their familial affiliations and cultural dietary habits and perceptions, as well as their BMI distribution.^{40,56-61} As results of this study show, Hispanic students had a higher BMI increase compared to the other ethnicities, and Caucasian students had a statistically significant BMI increase.

Results of this study indicate that although residence was not a significant factor in freshman weight gain, significant differences were noted in meal frequency and exercise patterns between the 2 populations. These results are supported by previous studies that show that lifestyle is in many ways dictated by the immediate environment and relevant circumstances, which contribute to differences in behavioral and dietary patterns between students that live on campus compared to those that live off campus.^{18,23,30,55}

This study also shows that freshman initial BMI upon entering college is another significant factor in their weight gain and even though results are contrary to those of previous studies^{9,16,20-21,49} in showing that normal weight and underweight individuals had a more significant increase in BMI, it suggests an association that may need to be evaluated on a specific population prior to establishing an intervention program.

In conclusion, not only is freshman weight gain multi-factorial in terms of dietary habits and physical activity patterns, the college freshman population is not a homogenous group of people and the phenomenon of freshman weight gain should be assessed in each sub-group individually by ethnicity, residence, gender, and initial BMI.

REFERENCES

1. Flegal KM. Trends in body weight and overweight in the US population. *Nutr Rev.* 1996;54:S97-100.
2. Flegal KM, Carroll MD, Kuczmarski RJ, et al. Overweight and obesity in the United States: prevalence and trends, 1960-1994. *Int J Obes Relat Metab Disord.* 1998;22:39-47.
3. Flegal KM, Carroll MD, Ogden CL, et al. Prevalence and trends in obesity among US adults, 1999-2000. *JAMA.* 2002;288:1723-1727.
4. Ogden CL, Carroll MD, Curtin LR, et al. Prevalence of overweight and obesity in the United States, 1999-2004. *JAMA.* 2006;295:1549-1555.
5. Pi-Sunyer FX. Medical hazards of obesity. *Ann Intern Med.* 1993;119:655-660.
6. National Institutes of Health. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: the evidence report. *Obes Res.* 1998;6 Suppl 2:51S-209S.
7. Finkelstein EA TJ, Cohen JW, Dietz, W. Annual medical spending attributable to obesity: payer- and service-specific estimates. *Health Aff.* 2009;28. w822-w831.
8. Whitaker RC, Wright JA, Pepe MS, et al. Predicting obesity in young adulthood from childhood and parental obesity. *N Engl J Med.* 1997;337:869-873.
9. Anderson DA, Shapiro JR, Lundgren JD. The freshman year of college as a critical period for weight gain: an initial evaluation. *Eat Behav.* 2003;4:363-367.
10. Cluskey M, Grobe D. College weight gain and behavior transitions: male and female differences. *J Am Diet Assoc.* 2009;109:325-329.
11. Hajhosseini L, Holmes, T, Mohamadid, P. Changes in body weight. *J Am Coll Nutr.* 2006;25:123-127.
12. Hoffman DJ, Policastro P, Quick V, et al. Changes in body weight and fat mass of men and women in the first year of college: a study of the "freshman 15". *J Am Coll Health.* 2006;55:41-45.
13. Levitsky DA, Halbmaier CA, Mrdjenovic G. The freshman weight gain: a model for the study of the epidemic of obesity. *Int J Obes Relat Metab Disord.* 2004;28:1435-1442.

14. Butler SM, Black DR, Blue CL, et al. Change in diet, physical activity, and body weight in female college freshman. *Am J Health Behav.* 2004;28:24-32.
15. Delinsky SS, Wilson GT. Weight gain, dietary restraint, and disordered eating in the freshman year of college. *Eat Behav.* 2008;9:82-90.
16. Edmonds MJ, Ferreira KJ, Nikiforuk EA, et al. Body weight and percent body fat increase during the transition from high school to university in females. *J Am Diet Assoc.* 2008;108:1033-1037.
17. Graham MA, Jones AL. Freshman 15: valid theory or harmful myth? *J Am Coll Health.* 2002;50:171-173.
18. Hovell MF, Mewborn CR, Randle Y, Fowler-Johnson S. Risk of excess weight gain in university women: a three-year community controlled analysis. *Addict Behav.* 1985;10:15-28.
19. Jung ME, Bray, SR, Ginis, KAM. Behavior change and the freshman 15: tracking physical activity and dietary patterns in 1st-year university women. *J Am Coll Health.* 2008;56:523-530.
20. Kasparek DG, Corwin S, Valois RF, et al. Selected health behaviors that influence college freshman weight gain. *J Am Coll Health.* 2008;56:437-444.
21. Mihalopoulos NL, Auinger P, Klein JD. The Freshman 15: is it real? *J Am Coll Health.* 2008;56:531-533.
22. Morrow M, Heesch KC, Dinger MK, et al. Freshman 15: fact or fiction? *Obesity.* 2006;14:1438-1443.
23. Pliner P, Saunders T. Vulnerability to freshman weight gain as a function of dietary restraint and residence. *Physiol Behav.* 2008;93:76-82.
24. Racette SB, Deusinger SS, Strube MJ, et al. Weight changes, exercise, and dietary patterns during freshman and sophomore years of college. *J Am Coll Health.* 2005;53:245-251.
25. Economos CD, Hildebrandt ML, Hyatt RR. College freshman stress and weight change: differences by gender. *Am J Health Behav.* 2008;32:16-25.
26. Holm-Denoma JM, Joiner TE, Vohs KD, Heatherton TF. The "Freshman Fifteen" (the "Freshman Five" actually): predictors and possible explanations. *Health Psychol.* 2008;27:S3-S9.

27. Lloyd-Richardson EE, Bailey S, Fava JL, et al. A prospective study of weight gain during the college freshman and sophomore years. *Prev Med*. 2009;48:256-261.
28. Lowe MR, Annunziato RA, Markowitz JT, et al. Multiple types of dieting prospectively predict weight gain during the freshman year of college. *Appetite*. 2006;47:83-90.
29. Brown JE, Isacacs JS, Krinke UB, et al. Adolescent Nutrition. In Brown JE, Isacacs JS, Krinke UB, Murtaugh MA, Sharbaugh C, Stang J, Woolridge NH. *Nutrition Through The Life Cycle*. 2nd ed. Belmont, CA: Thomson Wadsworth 2005:328
30. Brunt A, Rhee Y, Zhong L. Differences in dietary patterns among college students according to body mass index. *J Am Coll Health*. 2008;56:629-634.
31. Buijsse B, Feskens EJ, Schulze MB, et al. Fruit and vegetable intakes and subsequent changes in body weight in European populations: results from the project on Diet, Obesity, and Genes (DiOGenes). *Am J Clin Nutr*. 2009;90:202-209.
32. Centers for Disease Control and Prevention. Youth risk behavior surveillance--United States, 2007. *MMWR*. 2008;57:1-131.
33. American College of Sports Medicine. *Guidelines for Healthy Adults Under Age 65*. Available at: http://www.acsm.org/AM/Template.cfm?Section=Home_Page&TEMPLATE=/CM/HTMLDisplay.cfm&CONTENTID=7764. Accessed August 10, 2009.
34. Kimmons J, Gillespie C, Seymour J, et al. Fruit and vegetable intake among adolescents and adults in the United States: percentage meeting individualized recommendations. *Medscape J Med*. 2009;11:26.
35. Borrud L, Enns C. What we eat in America: USDA surveys foods consumption changes. *Food review* (online). September 1996;19:14-19. Available at: Academic Search Premier, Ipswich, MA. Accessed September 26, 2009.
36. Vartanian LR, Schwartz MB, Brownell KD. Effects of soft drink consumption on nutrition and health: a systematic review and meta-analysis. *Am J Public Health*. 2007;97:667-675.
37. DiMeglio DP, Mattes RD. Liquid versus solid carbohydrate: effects on food intake and body weight. *Int J Obes Relat Metab Disord*. 2000;24:794-800.
38. Timlin MT, Pereira MA, Story M, et al. Breakfast eating and weight change in a 5-year prospective analysis of adolescents: Project EAT (Eating Among Teens). *Pediatrics*. 2008;121:e638-645.

39. Niemeier HM, Raynor HA, Lloyd-Richardson EE, et al. Fast food consumption and breakfast skipping: predictors of weight gain from adolescence to adulthood in a nationally representative sample. *J Adolesc Health*. 2006;39:842-849.
40. Debate RD, Topping M, Sargent RG. Racial and gender differences in weight status and dietary practices among college students. *Adolescence*. 2001;36:819-833.
41. United States Department of Agriculture. Available at: <http://www.mypyramid.gov>. Accessed August 10, 2009.
42. Huang TT, Harris KJ, Lee RE, et al. Assessing overweight, obesity, diet, and physical activity in college students. *J Am Coll Health*. 2003;52:83-86.
43. Lowry R, Galuska DA, Fulton JE, et al. Physical activity, food choice, and weight management goals and practices among US college students. *Am J Prev Med*. 2000;18:18-27.
44. Brunt AR, Rhee YS. Obesity and lifestyle in US college students related to living arrangements. *Appetite*. 2008;51:615-621.
45. Hendricks KM, Herbold N, Fung T. Diet and other lifestyle behaviors in young college women. *Nutrition Research*. 2004;24:981-991.
46. Lloyd-Richardson EE, Lucero ML, Dibello JR, et al. The relationship between alcohol use, eating habits and weight change in college freshmen. *Eat Behav*. 2008;9:504-508.
47. Nelson MC, Lust K, Story M, et al. Alcohol use, eating patterns, and weight behaviors in a university population. *Am J Health Behav*. 2009;33:227-237.
48. Adams T, Rini A. Predicting 1-year change in body mass index among college students. *J Am Coll Health*. 2007;55:361-365.
49. Matvienko O, Lewis DS, Schafer E. A college nutrition science course as an intervention to prevent weight gain in female college freshmen. *J Nutr Educ*. 2001;33:95-101.
50. Kolodinsky J, Harvey-Berino JR, Berlin L, et al. Knowledge of current dietary guidelines and food choice by college students: better eaters have higher knowledge of dietary guidance. *J Am Diet Assoc*. 2007;107:1409-1413.

51. Rich SS, Thomas CR. Body mass index, disordered eating behavior, and acquisition of health information: examining ethnicity and weight-related issues in a college population. *J Am Coll Health*. 2008;56:623-628.
52. Beerman KA, Jennings G, Crawford S. The effect of student residence on food choice. *J Am Coll Health*. 1990;38:215-220.
53. Levi A, Chan KK, Pence D. Real men do not read labels: the effects of masculinity and involvement on college students' food decisions. *J Am Coll Health*. 2006;55:91-98.
54. Mooney KM, Walbourn L. When college students reject food: not just a matter of taste. *Appetite*. 2001;36:41-50.
55. Brown LB, Dresen RK, Eggett DL. College students can benefit by participating in a prepaid meal plan. *J Am Diet Assoc*. 2005;105:445-448.
56. Reference Group. Wikipedia, the free encyclopedia. Available at: http://en.wikipedia.org/wiki/Reference_group. Accessed September 26, 2009.
57. Schifter DE, Ajzen I. Intention, perceived control, and weight loss: an application of the theory of planned behavior. *J Pers Soc Psychol*. 1985;49:843-851.
58. Louis W, Davies S, Smith J, et al. Pizza and pop and the student identity: the role of referent group norms in healthy and unhealthy eating. *J Soc Psychol*. 2007;147:57-74.
59. Gillum RF, Sempos CT. Ethnic variation in validity of classification of overweight and obesity using self-reported weight and height in American women and men: the Third National Health and Nutrition Examination Survey. *Nutr J*. 2005;4:27. doi: 10.1186/1475-2891-4-27
60. Truong KD, Sturm R. Weight gain trends across sociodemographic groups in the United States. *Am J Public Health*. 2005;95:1602-1606.
61. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet*. 2004;363:157-163.
62. Sherry B, Jefferds ME, Grummer-Strawn LM. Accuracy of adolescent self-report of height and weight in assessing overweight status: a literature review. *Arch Pediatr Adolesc Med*. 2007;161:1154-1161.
63. Crombie AP, Ilich JZ, Dutton GR, et al. The freshman weight gain phenomenon revisited. *Nutr Rev*. 2009;67:83-94.

APPENDIX A: CONSENT FORMS

FALL CONSENT FORM

Consent form

Thank you for participating in the study "Examination of Eating Habits of College Freshman at an Ethnically Diverse Metropolitan University", which is being conducted by Professor Marjorie Freedman, PhD, and nutrition graduate students Ruchi Shrivastava and Leah Haritan. The purpose of this research is to examine eating habits and behaviors of freshmen at SJSU.

Your input is valuable and important; it will be used to help improve the dining experiences of students on campus.

To participate in this research, we hope you will complete the following 15 minute survey.

If you agree to participate, you will be asked to provide your student ID number. However, all information gathered will be kept confidential, and no information about you, as an individual, will be used in any shape or form, or disclosed to any individual, department, or entity at SJSU or elsewhere. Although the results of this study may be published, no information that could identify you will be included. There are no risks to you for completing this survey.

As an incentive to participate you will be entered into a drawing for \$25 worth of Gold Points (or a gift certificate to Spartan Bookstore). Ten students will be randomly selected to win one of these prizes. There will be a grand prize of an iPod (or cash equivalent).

Questions about this research may be addressed Dr. Marjorie Freedman, Nutrition, Food Science and Packaging Dept, SJSU (408) 924-3105 or marjorie.freedman@sjsu.edu. Complaints may be presented to Dr. Lucy McProud, Chair, NuFS, (408) 924-3100. Questions about your rights, or research-related injury may be directed to Pamela Stacks, Ph.D., AVP, Graduate Studies & Research (408) 924-2480.

No service of any kind, to which you are otherwise entitled, will be lost or jeopardized if you choose not to participate in the study. Your consent is being given voluntarily. You may refuse to participate in the entire study or in any part of the study. You have the right to answer only those questions you wish to answer. If you decide to participate in the study, you are free to withdraw at any time without any negative effect on your relations with SJSU or with any other participating institutions.

If you agree to participate in this research, please click CONTINUE, which will confirm that you have been fully informed of your rights and are voluntarily agreeing to participate in this research.

Please keep in mind that this survey will not let you go back to the previous question once you hit the next button. You can take as much time as you'd like to answer each question, but the survey must be completed in one sitting.

* 1. Please enter your student ID (Tower card number)

2. What is your age?

Years

3. How would you best describe your ethnicity? Please check all that apply

☐

Caucasian

☐

African American

☐

Middle Eastern

☐

South Asian

☐

Hispanic

☐

Asian

☐

Latino

Other (please specify)

4. What is your gender?

☐

Male

☐

Female

SPRING CONSENT FORM

Consent form

Thank you for your continued participation in our study examining freshman eating behaviors. Your input is valuable and important; it will be used to help improve the dining experiences of all students at SJSU.

We know you already participated in a similar survey conducted last fall. Some of the questions will seem familiar. Please answer them to the best of your ability and as honestly as possible.

As an incentive to participate you will be entered into a drawing for \$50 worth of Gold Points. At least five students will be randomly selected to win one of these prizes. There will be a grand prize of an IPOD (or cash equivalent). In addition, each week there will be drawings for fun prizes such as movie passes, and gift certificates to Starbucks and other local eateries.

All winners will be notified by email and posted on the Healthy Campus website (www.nufs.sjsu/healthcampus)

If you agree to participate, you will be asked to provide your student ID number. However, all information gathered will be kept confidential, and no information about you, as an individual, will be used in any shape or form, or disclosed to any individual, department, or entity at SJSU or elsewhere. Although the results of this study may be published, no information that could identify you will be included. There are no risks to you for completing this survey.

Questions about this research may be addressed Dr. Marjorie Freedman, Nutrition, at 924-3105 or marjorie.freedman@sjsu.edu. Complaints may be presented to Dr. Lucy McProud, Chair, NuFS, (408) 924-3100. Questions about your rights, or research-related injury may be directed to Pamela Stacks, Ph.D., AVP, Graduate Studies & Research (408) 924-2480.

No service of any kind, to which you are otherwise entitled, will be lost or jeopardized if you choose not to participate in the study. Your consent is being given voluntarily. You may refuse to participate in the entire study or in any part of the study. You have the right to answer only those questions you wish to answer. If you decide to participate in the study, you are free to withdraw at any time without any negative effect on your relations with SJSU or with any other participating institutions.

If you agree to participate in this research, please click CONTINUE, which will confirm that you have been fully informed of your rights and are voluntarily agreeing to participate in this research.

Please keep in mind that this survey will not let you go back to the previous question once you hit the next button. You can take as much time as you'd like to answer each question, but the survey must be completed in one sitting.

*** Please enter your student ID (Tower card number)**

What is your height?

Feet

Inches

What is your current weight?

Pounds

*** Do you live ON or OFF campus?**

☐

On campus

☐

Off campus

Where do you live?

☐

With my parents or grandparents

☐

At a fraternity or sorority house

☐

With friends or siblings off campus

☐

I live alone

APPENDIX B: IRB APPROVALS

**Office of the Provost
Associate Vice President
Graduate Studies & Research**

One Washington Square
San José, CA 95192-0025
Voice: 408-924-2427
Fax: 408-924-2477

E-mail: gradstudies@sjsu.edu
<http://www.sjsu.edu>

To: Dr. Marjorie Freedman
Department of Nutrition and Food Science
San Jose State University
One Washington Square
San Jose, CA 95192-0058

From: Pamela Stacks, Ph.D.
Associate Vice President
Graduate Studies and Research

Date: October 19, 2007

The Human Subjects-Institutional Review Board has approved your request to use human subjects in the study entitled:

"Healthy Eating Active Living 2007-2009"

This approval, which provides exempt status under Category B, is contingent upon the subjects included in your research project being appropriately protected from risk. This includes the protection of the anonymity of the subjects' identity when they participate in your research project, and with regard to all data that may be collected from the subjects. The approval includes continued monitoring of your research by the Board to assure that the subjects are being adequately and properly protected from such risks. If at any time a subject becomes injured or complains of injury, you must notify Dr. Pamela Stacks, Ph.D. immediately. Injury includes but is not limited to bodily harm, psychological trauma, and release of potentially damaging personal information. This approval for the human subject's portion of your project is in effect for one year, and data collection beyond October 19, 2008 requires an extension request.

Please also be advised that all subjects need to be fully informed and aware that their participation in your research project is voluntary, and that he or she may withdraw from the project at any time. Further, a subject's participation, refusal to participate, or withdrawal will not affect any services that the subject is receiving or will receive at the institution in which the research is being conducted.

If you have any questions, please contact me at (408) 924-2480.

cc. Anson Lee, 0139

The California State University:
Chancellor's Office
Bakersfield, Channel Islands, Chico,
Dominguez Hills, East Bay, Fresno,
Fullerton, Humboldt, Long Beach,
Los Angeles, Maritime Academy,
Monterey Bay, Northridge, Pomona,
Sacramento, San Bernardino, San Diego,
San Francisco, San José, San Luis Obispo,
San Marcos, Sonoma, Stanislaus

San José State
UNIVERSITY

**Office of the Provost
Associate Vice President
Graduate Studies & Research**

One Washington Square
San José, CA 95192-0025
Voice: 408-924-2427
Fax: 408-924-2477

E-mail: gradstudies@sjsu.edu
<http://www.sjsu.edu>

To: Dr. Marjorie Freedman
Department of Nutrition and Food Science
San Jose State University
One Washington Square
San Jose, CA 95192-0058

Leah Haritan

From: Pamela Stacks, Ph.D. *Pamela C Stacks*
Associate Vice President
Graduate Studies and Research

Date: January 28, 2008

The Human Subjects-Institutional Review Board has approved your request to use human subjects in the study entitled:

"Evaluation of factors influencing eating behaviors of freshman students on a culturally diverse urban campus"

This approval is contingent upon the subjects participating in your research project being appropriately protected from risk. This includes the protection of the anonymity of the subjects' identity when they participate in your research project, and with regard to all data that may be collected from the subjects. The approval includes continued monitoring of your research by the Board to assure that the subjects are being adequately and properly protected from such risks. If at any time a subject becomes injured or complains of injury, you must notify Dr. Pamela Stacks, Ph.D. immediately. Injury includes but is not limited to bodily harm, psychological trauma, and release of potentially damaging personal information. This approval for the human subject's portion of your project is in effect for one year, and data collection beyond January 28, 2009 requires an extension request.

Please also be advised that all subjects need to be fully informed and aware that their participation in your research project is voluntary, and that he or she may withdraw from the project at any time. Further, a subject's participation, refusal to participate, or withdrawal will not affect any services that the subject is receiving or will receive at the institution in which the research is being conducted.

If you have any questions, please contact me at (408) 924-2480.

Protocol # S0802010

The California State University:
Chancellor's Office
Bakersfield, Channel Islands, Chico,
Dominguez Hills, East Bay, Fresno,
Fullerton, Humboldt, Long Beach,
Los Angeles, Maritime Academy,
Monterey Bay, Northridge, Pomona,
Sacramento, San Bernardino, San Diego,
San Francisco, San José, San Luis Obispo,
San Marcos, Sonoma, Stanislaus

APPENDIX C: SURVEY INSTRUMENTS

FALL SURVEY

Consent form

Thank you for participating in the study "Examination of Eating Habits of College Freshman at an Ethnically Diverse Metropolitan University", which is being conducted by Professor Marjorie Freedman, PhD, and nutrition graduate students Ruchi Shrivastava and Leah Haritan. The purpose of this research is to examine eating habits and behaviors of freshmen at SJSU.

Your input is valuable and important; it will be used to help improve the dining experiences of students on campus.

To participate in this research, we hope you will complete the following 15 minute survey.

If you agree to participate, you will be asked to provide your student ID number. However, all information gathered will be kept confidential, and no information about you, as an individual, will be used in any shape or form, or disclosed to any individual, department, or entity at SJSU or elsewhere. Although the results of this study may be published, no information that could identify you will be included. There are no risks to you for completing this survey.

As an incentive to participate you will be entered into a drawing for \$25 worth of Gold Points (or a gift certificate to Spartan Bookstore). Ten students will be randomly selected to win one of these prizes. There will be a grand prize of an iPod (or cash equivalent).

Questions about this research may be addressed Dr. Marjorie Freedman, Nutrition, Food Science and Packaging Dept, SJSU (408) 924-3105 or marjorie.freedman@sjsu.edu. Complaints may be presented to Dr. Lucy McProud, Chair, NuFS, (408) 924-3100. Questions about your rights, or research-related injury may be directed to Pamela Stacks, Ph.D., AVP, Graduate Studies & Research (408) 924-2480.

No service of any kind, to which you are otherwise entitled, will be lost or jeopardized if you choose not to participate in the study. Your consent is being given voluntarily. You may refuse to participate in the entire study or in any part of the study. You have the right to answer only those questions you wish to answer. If you decide to participate in the study, you are free to withdraw at any time without any negative effect on your relations with SJSU or with any other participating institutions.

If you agree to participate in this research, please click CONTINUE, which will confirm that you have been fully informed of your rights and are voluntarily agreeing to participate in this research.

Please keep in mind that this survey will not let you go back to the previous question once you hit the next button. You can take as much time as you'd like to answer each question, but the survey must be completed in one sitting.

* 1. Please enter your student ID (Tower card number)

2. What is your age?

Years

3. How would you best describe your ethnicity? Please check all that apply

☐

Caucasian

☐

African American

☐

Middle Eastern

☐

South Asian

☐

Hispanic

☐

Asian

☐

Latino

Other (please specify)

4. What is your gender?

☐

Male

☐

Female

5. What is your height?

Feet

Inches

6. What is your current weight?

Pounds

*** 7. Do you live ON or OFF campus?**

☐

On campus

☐

Off campus

8. Approximately how many times have you been home since the beginning of the school year?

Times

9. Do you have access to a refrigerator?

☐

No

☐

Yes, there is one in my room

☐

Yes, there is a shared refrigerator on my floor

☐

Yes, there is a shared refrigerator in my building (not on my floor)

10. Do you have access to a kitchen/kitchenette?

☐

No

☐

Yes, there is one in my suite

☐

Yes, there is one on my floor

☐

Yes, there is one in my building

11. Which of the following pre-paid meal plans do you have through Spartan Dining?

☐

Traditional Plan A (185 meals + \$525 Gold Points)

☐

Traditional Plan B (160 meals + \$425 Gold Points)

☐

Traditional Plan C (120 meals + \$300 Gold Points)

12. Please rate the following statements on a scale from "Extremely important to me" to "Not at all important to me"

	Extremely important to me		Neutral		Not at all important to me
What I eat is	☐	☐	☐	☐	☐
Eating three meals a day is	☐	☐	☐	☐	☐
Eating fruits and vegetables is	☐	☐	☐	☐	☐
Eating dairy foods is	☐	☐	☐	☐	☐
My body weight is	☐	☐	☐	☐	☐
Drinking water is	☐	☐	☐	☐	☐
Drinking carbonated soft drinks (soda) is	☐	☐	☐	☐	☐
Drinking caffeinated beverages (coffee, Red Bull) is	☐	☐	☐	☐	☐
Snacking between meals is	☐	☐	☐	☐	☐

13. Are you currently taking any vitamin or mineral supplements? Please check all that apply

- ☐ No, I am not currently taking any vitamin or mineral supplements
- ☐ Yes, I take a multivitamin/mineral supplement (e.g. "One-a-Day")
- ☐ Yes, I take Vitamin C
- ☐ Yes, I take Vitamin E
- ☐ Yes, I take Calcium

Yes, I am taking other supplements (please specify)

14. Are you a vegetarian?

- ☐ No ☐ Yes

15. Do you consider yourself spiritual?

- ☐ No ☐ Yes

16. Do you consider yourself religious?

- ☐ No ☐ Yes

17. How would you best describe your current body weight?

- ☐ Underweight
- ☐ Just the right weight
- ☐ Overweight

18. Has your body weight changed since entering SJSU?

- ☐ No, my body weight is nearly the same (Within 5 lbs)
- ☐ Yes, I have GAINED weight since entering SJSU
- ☐ Yes, I have LOST weight since entering SJSU

19. Have you ever been on a diet?

- ☐ No
- ☐ Yes, I am CURRENTLY on a diet
- ☐ Yes, I have been on a diet within the past year but am not CURRENTLY on a diet
- ☐ Yes, I have been on a diet within the past 2-3 years but am not CURRENTLY on a diet

20. What type of diet are you currently on?

- ☐ I count calories
- ☐ I am on Weight Watchers
- ☐ I try to limit my carbs
- ☐ I try to limit my fat intake

Other (please specify)

21. I find the taste of _____

	Delicious				Disgusting
Fruits	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐
Milk	☐	☐	☐	☐	☐
Cheese	☐	☐	☐	☐	☐
Yogurt	☐	☐	☐	☐	☐
Water	☐	☐	☐	☐	☐
Carbonated soft drinks (e.g. soda, Coke, Sprite)	☐	☐	☐	☐	☐
Caffeinated beverages (e.g. coffee, Red Bull)	☐	☐	☐	☐	☐
Snacks available on campus	☐	☐	☐	☐	☐

The following questions ask you about your current eating habits as well as your eating habits before you entered SJSU as a freshman. They are asking about how many SERVINGS of certain foods you eat, so please add up the servings to answer the question.

22. Thinking about MILK and DAIRY PRODUCTS, and using the following serving sizes as a guide,

**How many servings of milk and dairy products do you typically consume EACH DAY?
How many servings did you typically consume each day BEFORE enrolling at SJSU?**

Each of the following is ONE serving, so ADD up all you eat to get your daily intake

**1 cup (8 oz) milk or yogurt OR
1.5 oz cheese (cheddar, swiss, jack) OR
2 oz processed cheese (cheese spread, American cheese) OR
1/2 cup of ice cream or frozen yogurt OR
1/2 cup pudding made with milk**

	0	1 serving/day	2 servings/day	3 servings/day	4 or more servings/day
Current intake (servings/day)	☐	☐	☐	☐	☐
Past intake (servings/day)	☐	☐	☐	☐	☐

23. Thinking about FRESH (raw) FRUIT, and using the following serving sizes as a guide,

**How many servings of fresh (raw) fruit do you typically consume EACH DAY?
How many servings did you typically consume each day BEFORE enrolling at SJSU?**

Each of the following is ONE serving, so ADD up all you eat to get your daily intake

**1 medium piece of fruit (e.g. apple, orange, banana, peach, plum, mango) OR
1/2 cup fresh fruit (e.g. watermelon, cantaloupe, strawberries, pineapple, blueberries)**

	0	1 serving/day	2 servings/day	3 servings/day	4 or more servings/day
Current intake (servings/day)	☐	☐	☐	☐	☐
Past intake (servings/day)	☐	☐	☐	☐	☐

24. Thinking about OTHER FRUIT PRODUCTS (excluding fresh raw fruits), and using the following serving sizes as a guide,

How many servings of other fruit products do you typically consume EACH DAY?

How many servings did you typically consume each day BEFORE enrolling at SJSU?

Each of the following is ONE serving, so ADD up all you eat to get your daily intake

1/2 cup (4 oz) 100% fruit juice OR

1/2 cup (4 oz) Jamba juice--so one 16 oz cup is 4 servings --OR

1/2 cup frozen or canned fruit OR

1/4 cup dried fruit

	0	1 serving/day	2 servings/day	3 servings/day	4 or more servings/day
Current intake (servings/day)	☐	☐	☐	☐	☐
Past intake (servings/day)	☐	☐	☐	☐	☐

25. Thinking about VEGETABLES (excluding potato), and using the following serving sizes as a guide,

How many servings of vegetables (excluding potato) do you typically consume EACH DAY?

How many servings did you typically consume each day BEFORE enrolling at SJSU?

Each of the following is ONE serving, so ADD up all you eat to get your daily intake

1/2 cup vegetables (carrots, tomatoes, zucchini, mushrooms, corn, peas, broccoli) OR

1 cup salad (lettuce, spinach)

	0	1 serving/day	2 servings/day	3 servings/day	4 or more servings/day
Current intake (servings/day)	☐	☐	☐	☐	☐
Past intake (servings/day)	☐	☐	☐	☐	☐

26. Thinking about other VEGETABLES (excluding potato), and using the following serving sizes as a guide,

How many servings of all other vegetables (excluding potato) do you typically consume EACH DAY?

How many servings did you typically consume each day BEFORE enrolling at SJSU?

Each of the following is ONE serving, so ADD up all you eat to get your daily intake

1/2 cup vegetable juice or

1/2 cup cooked vegetables in soup, stew, stir fry or other vegetable dishes

	0	1 serving/day	2 servings/day	3 servings/day	4 or more servings/day
Current intake (servings/day)	☐	☐	☐	☐	☐
Past intake (servings/day)	☐	☐	☐	☐	☐

27. The _____ of foods is...

	Extremely Important to me		Neutral		Not at all Important to me
taste	☐	☐	☐	☐	☐
nutritional content	☐	☐	☐	☐	☐
cost	☐	☐	☐	☐	☐
convenience (minimum cooking involved, easy to eat, portability)	☐	☐	☐	☐	☐
availability (access to food when you want it)	☐	☐	☐	☐	☐
fat content	☐	☐	☐	☐	☐
cultural appropriateness	☐	☐	☐	☐	☐
quality	☐	☐	☐	☐	☐
appearance	☐	☐	☐	☐	☐
popularity or "cool factor"	☐	☐	☐	☐	☐

28. How often do you typically snack between...

	Never	Sometimes (1 - 3 times/week)	Often (4 - 6 times/week)	Every day
Lunch and dinner	☐	☐	☐	☐
Dinner and 11 p.m.	☐	☐	☐	☐

29. What do you typically snack on? Please check all that apply.

☐ Bagged snacks (e.g. chips, pretzels)	☐ Energy bars	☐ Chocolate/candy
☐ Fresh or dried fruit	☐ Cookies or other baked goods	
☐ Vegetables	☐ Jamba Juice	

Other (please specify)

30. Where do you normally obtain your snacks?

	Check all that apply	How often do you get them here?
I live OFF CAMPUS, and I get them at home, or bring them from home	☐	☐
I purchase them on campus (e.g. Village Market, Market Cafe, Jamba Juice)	☐	☐
I purchase them on campus from a vending machine	☐	☐
I take them from the dining commons	☐	☐
I purchase them off campus (convenience store, grocery store)	☐	☐
Other (please specify where and how often)		
<input type="text"/>		

31. How many times PER WEEK do you have a LATE NIGHT snack between 11 pm and 5 am?

- ☐ Never ☐ Often (4-6x/week)
- ☐ Sometimes (1-3x/week) ☐ Daily

32. What do you usually snack on between 11 pm and 5 am?

- ☐ Bagged snacks (e.g. chips, pretzels) ☐ Fast foods (e.g. pizza, sandwich, hamburger) ☐ Cookies or other baked goods
- ☐ Fruits ☐ Cereal ☐ Chocolate/candy
- ☐ Vegetables ☐ Energy bars

Other (please specify)

33. How many people do you USUALLY snack with between 11 pm and 5 am?

- ☐ I typically snack alone ☐ 1-2 family members ☐ More than 2 family members
- ☐ 1-2 peers/friends ☐ More than 2 peers/friends

34. Where do you normally obtain your late night snacks?

	Choose all that apply	How often do you get them there?
I live OFF CAMPUS, and I get them at home, or bring them from home	☐	☐
I purchase them on campus (e.g. Village Market, Market Cafe, Jamba Juice)	☐	☐
I purchase them on campus from a vending machine	☐	☐
I take them from the dining commons	☐	☐
I purchase them off campus (convenience store, grocery store)	☐	☐
Other (please specify where and how often)		
<input type="text"/>		

35. My intake of _____ depends upon their availability on campus

	Strongly Agree		Neutral		Strongly Disagree
Fruits and vegetables	☐	☐	☐	☐	☐
Water	☐	☐	☐	☐	☐
Beverages (other than water): coffee, tea, energy drinks	☐	☐	☐	☐	☐
Snacks (all types and kinds)	☐	☐	☐	☐	☐
Dairy products (milk, yogurt, ice cream)	☐	☐	☐	☐	☐

36. Drinking water _____

	Strongly Agree		Neutral		Strongly Disagree
helps my skin look good	☐	☐	☐	☐	☐
helps me look attractive	☐	☐	☐	☐	☐
helps me get better grades	☐	☐	☐	☐	☐
gives me more energy	☐	☐	☐	☐	☐
helps me lose or maintain weight	☐	☐	☐	☐	☐
is good for my health	☐	☐	☐	☐	☐
is no different than drinking any other beverage	☐	☐	☐	☐	☐

37. How would you describe your CURRENT daily intake of water and your PAST daily intake of water?

Note: 1 cup is 8 ounces; one BOTTLE (Aquafina) is typically 16-20 ounces or 2-3 cups.

	How many cups?	What type of water do you drink?
Current water intake (cups/day)	<input type="text"/>	<input type="text"/>
Past water intake (cups/day)	<input type="text"/>	<input type="text"/>

38. Do you use refillable water bottles?

☐ No

☐ Yes

39. How often do you consume the following beverages?

	Current Intake (NOW)	Past Intake (BEFORE SJSU)
Milk (all types and kinds)	<input type="text"/>	<input type="text"/>
Soy milk	<input type="text"/>	<input type="text"/>
Carbonated soft drinks (e.g. Coke, Sprite)	<input type="text"/>	<input type="text"/>
DIET beverages (diet Coke, Crystal light, sparkling water)	<input type="text"/>	<input type="text"/>
Energy drinks (e.g. Red Bull, Monster)	<input type="text"/>	<input type="text"/>
Electrolyte replacement drinks (e.g. Gatorade, Allsport)	<input type="text"/>	<input type="text"/>
Coffee (All types and kinds, including Starbucks, Peets)	<input type="text"/>	<input type="text"/>
Tea (Any type)	<input type="text"/>	<input type="text"/>
100% fruit/vegetable juice (orange, apple, tomato, V-8)	<input type="text"/>	<input type="text"/>
Jamba juice	<input type="text"/>	<input type="text"/>

40. Where do you obtain your beverages MOST of the time?

	Choose all that apply	How often do you get them there?
I live OFF CAMPUS and I get them at home, or bring from home	<input type="text"/>	<input type="text"/>
I live ON CAMPUS and I get them from the Dining Commons	<input type="text"/>	<input type="text"/>
Vending machines on campus	<input type="text"/>	<input type="text"/>
On campus venues (Village Market, Jazzland Cafe, Burger King, Jamba Juice)	<input type="text"/>	<input type="text"/>
Off campus venues (any restaurant, grocery store, Starbucks, etc)	<input type="text"/>	<input type="text"/>

41. How often do you eat the following meals:

	Current Intake (NOW)	Past Intake (BEFORE SJSU)
Breakfast	<input type="text"/>	<input type="text"/>
Lunch	<input type="text"/>	<input type="text"/>
Dinner	<input type="text"/>	<input type="text"/>

42. Who do you TYPICALLY eat with?

	I skip the meal	I eat alone	With 1-2 peers/friends	With 1-2 family members	With >2 peers/friends	With >2 family members
Breakfast	☐	☐	☐	☐	☐	☐
Lunch	☐	☐	☐	☐	☐	☐
Dinner	☐	☐	☐	☐	☐	☐

43. Where do you normally obtain your breakfast?

	Choose all that apply	How often do you get it there?
I live OFF CAMPUS and eat it at home or in the car before coming to SJSU	☐	☐
Dining Commons	☐	☐
I purchase it ON campus at one of the eateries (e.g. Market Cafe, Burger King, Jazzland Cafe, Jamba Juice)	☐	☐
I purchase it OFF campus (fast food, sit down, take out)	☐	☐
I purchase it from a vending machine	☐	☐
I live ON CAMPUS and prepare it in my own kitchen/kitchenette	☐	☐
Other (please specify)	<input type="text"/>	

44. Where do you normally obtain your lunch?

	Choose all that apply	How often do you get it there?
I live OFF CAMPUS, and I eat it at home, or I bring it from home	☐	☐
Dining Commons	☐	☐
ON campus eatery (e.g. Market Cafe, Burger King, Sbarro, Food Court, Jamba Juice, Subway)	☐	☐
OFF campus eatery (fast food, sit down, take out)	☐	☐
Vending Machine	☐	☐
I live ON CAMPUS and prepare it in my own kitchen/kitchenette	☐	☐
Other (please specify)	<input type="text"/>	

45. Where do you normally obtain your dinner?

	Choose all that apply	How often do you get it there?
I live OFF CAMPUS, and I eat it at home, or I bring it from home	☐	☐
Dining Commons	☐	☐
Vending machine	☐	☐
ON campus eatery (e.g. Market Cafe, Burger King, Sbarro, Food Court, Jamba Juice, Subway)	☐	☐
OFF campus eatery (fast food, sit down, take out)	☐	☐
I live ON CAMPUS and prepare it in my own kitchen/kitchenette	☐	☐
Other (please specify)	<input type="text"/>	

46. Eating fruits and vegetables _____

	Strongly agree		Neutral		Strongly disagree
is good for my health	☐	☐	☐	☐	☐
helps me lose or maintain weight	☐	☐	☐	☐	☐
helps me get better grades	☐	☐	☐	☐	☐
helps me look attractive	☐	☐	☐	☐	☐
does not make a difference	☐	☐	☐	☐	☐
gives me more energy	☐	☐	☐	☐	☐

47. Have your dietary habits changed since entering SJSU?

- ☐ No, I eat pretty much the same now compared to before coming to SJSU
- ☐ Yes, my diet is WORSE now
- ☐ Yes, my diet is BETTER now

What is the most significant change in your dietary habits since entering SJSU?

48. Please rate the following statements on a scale from "Very satisfied" to "Not at all satisfied"

	I am very satisfied		I am neither satisfied nor unsatisfied		I am not at all satisfied
The quantity of fruits and vegetables I eat	☐	☐	☐	☐	☐
My current body weight	☐	☐	☐	☐	☐
The quantity of water I drink	☐	☐	☐	☐	☐
My current diet and food choices	☐	☐	☐	☐	☐
The availability of fruits and vegetables on campus	☐	☐	☐	☐	☐
The availability of drinking water (bottled, water fountains, places to refill bottles) on campus	☐	☐	☐	☐	☐
The quantity of snacks I eat	☐	☐	☐	☐	☐
The availability of snacks on campus	☐	☐	☐	☐	☐
The quantity of dairy foods I eat	☐	☐	☐	☐	☐
The availability of dairy foods on campus	☐	☐	☐	☐	☐

49. Please rate the following statements on a scale from "Strongly Agree" to "Strongly Disagree"

	Strongly Agree		Neutral		Strongly Disagree
If I knew that what I eat could prevent disease, I would change my eating habits	☐	☐	☐	☐	☐
If campus food venues are open late at night (e.g. midnight), I would eat there more often.	☐	☐	☐	☐	☐

50. Please rate the following statements on a scale from "Strongly Agree" to "Strongly Disagree"

	Strongly Agree		Neutral		Strongly Disagree
If I knew that production or transportation of certain foods negatively affects the environment (wastes resources, increases global warming), I would avoid those foods or eat less of them	☐	☐	☐	☐	☐
If the cost of fruits and vegetables on campus is lower, I would eat more fruits and vegetables	☐	☐	☐	☐	☐
If the cost of clean and safe drinking water on campus is lower, I would drink more water	☐	☐	☐	☐	☐
If there is a water station for refilling water bottles on campus, I would drink more water	☐	☐	☐	☐	☐

51. Please rate the following statements on a scale from "Strongly Agree" to "Strongly Disagree"

	Strongly Agree		Neutral		Strongly Disagree
It is unnecessary for me to eat fruits and vegetables if I take vitamin supplements	☐	☐	☐	☐	☐
It is unnecessary for me to eat dairy products (e.g. milk, cheese, yogurt)	☐	☐	☐	☐	☐
Drinking juice is just as beneficial as drinking water	☐	☐	☐	☐	☐
Drinking carbonated soft drinks is just as beneficial as drinking water	☐	☐	☐	☐	☐
Drinking caffeinated beverages is just as beneficial as drinking water	☐	☐	☐	☐	☐

52. Eating dairy products _____

	Strongly agree		Neutral		Strongly disagree
helps me get better grades	☐	☐	☐	☐	☐
makes me healthier	☐	☐	☐	☐	☐
helps me lose or maintain weight	☐	☐	☐	☐	☐
does not make a difference	☐	☐	☐	☐	☐
helps me look attractive	☐	☐	☐	☐	☐
gives me more energy	☐	☐	☐	☐	☐

53. Please rate the following from "Extremely important to me" to "Not at all important to me"

	Extremely important to me		Neutral		Not at all important to me
Avoiding food that is highly processed is	☐	☐	☐	☐	☐
Eating organic food	☐	☐	☐	☐	☐
Avoiding foods that involves inhumane treatment of animals is	☐	☐	☐	☐	☐
Eating food that does not waste resources is	☐	☐	☐	☐	☐
How food is packaged is	☐	☐	☐	☐	☐
Where food is grown (local vs far away) is	☐	☐	☐	☐	☐
You're almost finished. . great work!!!					

54. Of the following people, whose opinions do you value? Please check all that apply.

☐ My parents	☐ My roommate	☐ My teachers/ professors
☐ My siblings	☐ My friends from high school	☐ Celebrities
☐ Other family members	☐ My college friends	☐ Bloggers
☐ My boyfriend/girlfriend/spouse	☐ My RA (resident advisor)	

Other (please specify)

55. People whose opinions are important to me think that _____

	Extremely important		Neutral		Not at all Important
eating fruits & vegetables every day is	☐	☐	☐	☐	☐
drinking water is	☐	☐	☐	☐	☐
what I eat is	☐	☐	☐	☐	☐
drinking caffeinated beverages is	☐	☐	☐	☐	☐
how much I weigh is	☐	☐	☐	☐	☐
drinking carbonated soft drinks is	☐	☐	☐	☐	☐
watching what and how much to snack on is	☐	☐	☐	☐	☐
eating dairy products is	☐	☐	☐	☐	☐

56. If I have more convenient access to ...

	Extremely Likely		Neutral		Extremely Unlikely
a refrigerator, I will eat more fruits and vegetables	☐	☐	☐	☐	☐
a refrigerator, I will eat more dairy products	☐	☐	☐	☐	☐
a greater variety of fruits & vegetables on campus, I will eat more of them	☐	☐	☐	☐	☐
clean and safe drinking water on campus, I would drink more water	☐	☐	☐	☐	☐
a greater variety of dairy products on campus, I will eat more of them	☐	☐	☐	☐	☐
a farmers' market on campus, I would eat more fruits and vegetables	☐	☐	☐	☐	☐

57. If I have more access to _____ I would make different food choices.

	Extremely Likely		Neutral		Extremely Unlikely
nutrition information (e.g. printed material, lectures, on-line, emails)	☐	☐	☐	☐	☐
nutrition counseling (e.g. one on one, group, or Internet)	☐	☐	☐	☐	☐
information on nutritional value of foods (e.g. labeling) at campus food venues	☐	☐	☐	☐	☐

58. If the following items were less visible/available on campus, I would consume less of those items.

	Extremely Likely		Neutral		Extremely Unlikely
Carbonated soft drinks (Coke, Sprite)	☐	☐	☐	☐	☐
Caffeinated beverages (coffee, Red Bull)	☐	☐	☐	☐	☐
"Junk foods"	☐	☐	☐	☐	☐

59. If the following items were more visible/available on campus, I would consume more of those items.

	Extremely Likely		Neutral		Extremely Unlikely
Vegetarian options	☐	☐	☐	☐	☐
Fruits and vegetables	☐	☐	☐	☐	☐
Ethnically diverse food items	☐	☐	☐	☐	☐

60. Next semester I intend to...

	Extremely Likely		Neutral		Extremely Unlikely
eat more dairy products	☐	☐	☐	☐	☐
drink fewer carbonated soft drinks (soda)	☐	☐	☐	☐	☐
watch my weight and balance my food intake with appropriate exercise	☐	☐	☐	☐	☐
eat fewer snacks	☐	☐	☐	☐	☐
drink more water	☐	☐	☐	☐	☐
eat more fruits and vegetables	☐	☐	☐	☐	☐
drink fewer caffeinated beverages (coffee, Red Bull)	☐	☐	☐	☐	☐

There are only a few more questions, thanks for hanging in there!

61. Are you currently a member of an athletic team?

☐ No ☐ Yes

If yes, which one?

62. Were you a member of an athletic team in high school?

☐ No ☐ Yes

If yes, which one?

63. Are you currently a member of a Sports, Health, Fitness, or Dance Club?

☐ No
☐ Yes, on campus (Sports Club)
☐ Yes, off campus

64. How many times PER WEEK do you do exercise MODERATELY? Please check all that apply.

	Never	1x/week	2x/week	3x/week	4x/week	5x/week	6x/week	7x/week
Walking briskly (about 3.5 miles per hour or 17 min per mile)	☐	☐	☐	☐	☐	☐	☐	☐
Hiking	☐	☐	☐	☐	☐	☐	☐	☐
Dancing	☐	☐	☐	☐	☐	☐	☐	☐
Golf	☐	☐	☐	☐	☐	☐	☐	☐
Biking (Less than 10 miles per hour)	☐	☐	☐	☐	☐	☐	☐	☐
Light weight training	☐	☐	☐	☐	☐	☐	☐	☐

65. On average, how many minutes do you do MODERATE exercise each time?

☐ I don't exercise
 ☐ 20-30 minutes
 ☐ More than 60 minutes
☐ 10-20 minutes
 ☐ 30-60 minutes

66. How many times PER WEEK do you exercise VIGOROUSLY? Please check all that apply.

	Never	1x/week	2x/week	3x/week	4x/week	5x/week	6x/week	7x/week
Running/jogging (5 miles per hour or 12 min per mile)	☐	☐	☐	☐	☐	☐	☐	☐
Biking (More than 10 miles per hour)	☐	☐	☐	☐	☐	☐	☐	☐
Swimming	☐	☐	☐	☐	☐	☐	☐	☐
Aerobics	☐	☐	☐	☐	☐	☐	☐	☐
Walking fast (4.5 miles per hour)	☐	☐	☐	☐	☐	☐	☐	☐
Heavy weight lifting	☐	☐	☐	☐	☐	☐	☐	☐
Competitive sports (e.g. Basketball, football, soccer)	☐	☐	☐	☐	☐	☐	☐	☐

67. On average, how many minutes do you do VIGOROUS exercise each time?

☐ I don't exercise
 ☐ 20-30 minutes
 ☐ More than 60 minutes
☐ 10-20 minutes
 ☐ 30-60 minutes

68. How long have you been exercising at this pace?

☐ I have just started
 ☐ Since I entered SJSU in
☐ For the past 4-6 weeks
 ☐ Since BEFORE entering SJSU

69. Has your exercise routine changed since entering SJSU?

☐ No, my exercise routine is the same as before
☐ Yes, I exercise MORE now
☐ Yes, I exercise LESS now

You're done!! Thanks so much for participating! You will be notified if you won a prize by email.

SPRING SURVEY

Consent form

Thank you for your continued participation in our study examining freshman eating behaviors. Your input is valuable and important; it will be used to help improve the dining experiences of all students at SJSU.

We know you already participated in a similar survey conducted last fall. Some of the questions will seem familiar. Please answer them to the best of your ability and as honestly as possible.

As an incentive to participate you will be entered into a drawing for \$50 worth of Gold Points. At least five students will be randomly selected to win one of these prizes. There will be a grand prize of an iPod (or cash equivalent). In addition, each week there will be drawings for fun prizes such as movie passes, and gift certificates to Starbucks and other local eateries.

All winners will be notified by email and posted on the Healthy Campus website (www.nufs.sjsu/healthcampus)

If you agree to participate, you will be asked to provide your student ID number. However, all information gathered will be kept confidential, and no information about you, as an individual, will be used in any shape or form, or disclosed to any individual, department, or entity at SJSU or elsewhere. Although the results of this study may be published, no information that could identify you will be included. There are no risks to you for completing this survey.

Questions about this research may be addressed Dr. Marjorie Freedman, Nutrition, at 924-3105 or marjorie.freedman@sjsu.edu. Complaints may be presented to Dr. Lucy McProud, Chair, NuFS, (408) 924-3100. Questions about your rights, or research-related injury may be directed to Pamela Stacks, Ph.D., AVP, Graduate Studies & Research (408) 924-2480.

No service of any kind, to which you are otherwise entitled, will be lost or jeopardized if you choose not to participate in the study. Your consent is being given voluntarily. You may refuse to participate in the entire study or in any part of the study. You have the right to answer only those questions you wish to answer. If you decide to participate in the study, you are free to withdraw at any time without any negative effect on your relations with SJSU or with any other participating institutions.

If you agree to participate in this research, please click CONTINUE, which will confirm that you have been fully informed of your rights and are voluntarily agreeing to participate in this research.

Please keep in mind that this survey will not let you go back to the previous question once you hit the next button. You can take as much time as you'd like to answer each question, but the survey must be completed in one sitting.

*** Please enter your student ID (Tower card number)**

What is your height?

Feet

Inches

What is your current weight?

Pounds

*** Do you live ON or OFF campus?**

☐

On campus

☐

Off campus

Where do you live?

☐

With my parents or grandparents

☐

At a fraternity or sorority house

☐

With friends or siblings off campus

☐

I live alone

Approximately how many times have you been home since the beginning of the Spring semester?

Times

How would you best describe your current body weight?

- ☐ Underweight
- ☐ Just the right weight
- ☐ Overweight

Have you ever been on a diet?

- ☐ No
- ☐ Yes, I am CURRENTLY on a diet
- ☐ Yes, I have been on a diet within the past semester (since January) but am not CURRENTLY on a diet

The following questions ask you about your current eating habits. We would like to know about how many SERVINGS of certain foods you eat, so please add up the servings to answer the question.

Thinking about MILK and DAIRY PRODUCTS, and using the following serving sizes as a guide,

How many servings of milk and dairy products do you typically consume EACH DAY?

Each of the following is ONE serving, so ADD up all you eat to get your daily intake

1 cup (8 oz) milk or yogurt OR
1.5 oz cheese (cheddar, swiss, jack) OR
2 oz processed cheese (cheese spread, American cheese) OR
1/2 cup of ice cream or frozen yogurt OR
1/2 cup pudding made with milk

	0	1/day	2/day	3/day	4 or more/day
Servings/day	☐	☐	☐	☐	☐

Thinking about FRESH (raw) FRUIT, and using the following serving sizes as a guide,

How many servings of fresh (raw) fruit do you typically consume EACH DAY?

Each of the following is ONE serving, so ADD up all you eat to get your daily intake

1 medium piece of fruit (e.g. apple, orange, banana, peach, plum, mango) OR
1/2 cup fresh fruit (e.g. watermelon, cantaloupe, strawberries, pineapple, blueberries)

	0	1/day	2/day	3/day	4 or more/day
Servings/day	☐	☐	☐	☐	☐

Thinking about OTHER FRUIT PRODUCTS (excluding fresh raw fruits), and using the following serving sizes as a guide,

How many servings of other fruit products do you typically consume EACH DAY?

Each of the following is ONE serving, so ADD up all you eat to get your daily intake

1/2 cup (4 oz) 100% fruit juice OR

1/2 cup (4 oz) Jamba juice--so one 16 oz cup is 4 servings --OR

1/2 cup frozen or canned fruit OR

1/4 cup dried fruit

	0	1/day	2/day	3/day	4 or more/day
Servings/day	☐	☐	☐	☐	☐

Thinking about VEGETABLES (excluding potato), and using the following serving sizes as a guide,

How many servings of vegetables (excluding potato) do you typically consume EACH DAY?

Each of the following is ONE serving, so ADD up all you eat to get your daily intake

1/2 cup vegetables (carrots, tomatoes, zucchini, mushrooms, corn, peas, broccoli) OR

1 cup salad (lettuce, spinach)

	0	1/day	2/day	3/day	4 or more/day
Servings/day	☐	☐	☐	☐	☐

Thinking about OTHER VEGETABLES (excluding potato), and using the following serving sizes as a guide,

How many servings of all other vegetables (excluding potato) do you typically consume EACH DAY?

Each of the following is ONE serving, so ADD up all you eat to get your daily intake

1/2 cup vegetable juice OR

1/2 cup cooked vegetables in soup, stew, stir fry or other dishes that include vegetables

	0	1/day	2/day	3/day	4 or more/day
Servings/day	☐	☐	☐	☐	☐

The _____ of foods is...

	Not at all Important to me		Neutral		Extremely Important to me
taste	☐	☐	☐	☐	☐
nutritional content	☐	☐	☐	☐	☐
cost	☐	☐	☐	☐	☐
convenience (minimum cooking involved, easy to eat, portability)	☐	☐	☐	☐	☐
availability (access to food when you want it)	☐	☐	☐	☐	☐
fat content	☐	☐	☐	☐	☐
cultural appropriateness	☐	☐	☐	☐	☐
quality	☐	☐	☐	☐	☐
appearance	☐	☐	☐	☐	☐
popularity or "cool factor"	☐	☐	☐	☐	☐

I find the taste of _____

	Disgusting				Delicious
Fruits	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐
Milk	☐	☐	☐	☐	☐
Cheese	☐	☐	☐	☐	☐
Yogurt	☐	☐	☐	☐	☐
Water	☐	☐	☐	☐	☐
Carbonated soft drinks (e.g. soda, Coke, Sprite)	☐	☐	☐	☐	☐
Caffeinated beverages (e.g. coffee, Red Bull)	☐	☐	☐	☐	☐
Snacks available on campus	☐	☐	☐	☐	☐

Are you currently a member of an athletic team?

☐ No

☐ Yes

If yes, which one?

Are you currently a member of a Sports, Health, Fitness, or Dance Club?

☐ No

☐ Yes, on campus (Sports Club)

☐ Yes, off campus

How many times PER WEEK do you do exercise MODERATELY? Please check all that apply.

	Never	1x/week	2x/week	3x/week	4x/week	5x/week	6x/week	7x/week
Walking briskly (about 3.5 miles per hour or 17 min per mile)	☐	☐	☐	☐	☐	☐	☐	☐
Hiking	☐	☐	☐	☐	☐	☐	☐	☐
Dancing	☐	☐	☐	☐	☐	☐	☐	☐
Golf	☐	☐	☐	☐	☐	☐	☐	☐
Biking (Less than 10 miles per hour)	☐	☐	☐	☐	☐	☐	☐	☐
Light weight training	☐	☐	☐	☐	☐	☐	☐	☐

On average, how many minutes do you do MODERATE exercise each time?

☐ I don't exercise
 ☐ 20-30 minutes
 ☐ More than 60 minutes

☐ 10-20 minutes
 ☐ 30-60 minutes

How many times PER WEEK do you exercise VIGOROUSLY? Please check all that apply.

	Never	1x/week	2x/week	3x/week	4x/week	5x/week	6x/week	7x/week
Running/jogging (5 miles per hour or 12 min per mile)	☐	☐	☐	☐	☐	☐	☐	☐
Biking (More than 10 miles per hour)	☐	☐	☐	☐	☐	☐	☐	☐
Swimming	☐	☐	☐	☐	☐	☐	☐	☐
Aerobics	☐	☐	☐	☐	☐	☐	☐	☐
Walking fast (4.5 miles per hour)	☐	☐	☐	☐	☐	☐	☐	☐
Heavy weight lifting	☐	☐	☐	☐	☐	☐	☐	☐
Competitive sports (e.g. Basketball, football, soccer)	☐	☐	☐	☐	☐	☐	☐	☐

On average, how many minutes do you do VIGOROUS exercise each time?

☐ I don't exercise
 ☐ 20-30 minutes
 ☐ More than 60 minutes

☐ 10-20 minutes
 ☐ 30-60 minutes

How long have you been exercising at this pace?

☐ I have just started
 ☐ Since I entered SJSU in the fall

☐ For the past 4-6 weeks
 ☐ Since BEFORE entering SJSU

Has your exercise routine changed over the past semester?

☐ No, my exercise routine is the same as before

☐ Yes, I exercise MORE now

☐ Yes, I exercise LESS now

My intake of _____ depends upon their availability on campus

	Strongly Disagree		Neutral		Strongly Agree
Fruits and vegetables	☐	☐	☐	☐	☐
Water	☐	☐	☐	☐	☐
Beverages (other than water): coffee, tea, energy drinks	☐	☐	☐	☐	☐
Snacks (all types and kinds)	☐	☐	☐	☐	☐
Dairy products (milk, yogurt, ice cream)	☐	☐	☐	☐	☐

Drinking water _____

	Strongly Disagree		Neutral		Strongly Agree
helps me get better grades	☐	☐	☐	☐	☐
helps my skin look good	☐	☐	☐	☐	☐
is good for my health	☐	☐	☐	☐	☐
is no different than drinking any other beverage	☐	☐	☐	☐	☐
helps me lose or maintain weight	☐	☐	☐	☐	☐
helps me look attractive	☐	☐	☐	☐	☐
gives me more energy	☐	☐	☐	☐	☐

Please rate the following statements on a scale from "Not at all important to me" to "Extremely important to me"

	Not at all important to me		Neutral		Extremely important to me
What I eat is	☐	☐	☐	☐	☐
Drinking carbonated soft drinks (soda) is	☐	☐	☐	☐	☐
Eating three meals a day is	☐	☐	☐	☐	☐
My body weight is	☐	☐	☐	☐	☐
Eating dairy foods is	☐	☐	☐	☐	☐
Eating fruits and vegetables is	☐	☐	☐	☐	☐
Drinking caffeinated beverages (coffee, Red Bull) is	☐	☐	☐	☐	☐
Snacking between meals is	☐	☐	☐	☐	☐
Drinking water is	☐	☐	☐	☐	☐

How often do you typically snack between...

	Never	Sometimes (1 - 3 times/week)	Often (4 - 6 times/week)	Every day
Lunch and dinner	☐	☐	☐	☐
Dinner and 11 p.m.	☐	☐	☐	☐

What do you typically snack on? Please check all that apply.

☐ Bagged snacks (e.g. chips, pretzels)	☐ Energy bars	☐ Chocolate/candy
☐ Fresh or dried fruit	☐ Cookies or other baked goods	☐ Cereal
☐ Vegetables	☐ Jamba Juice	

Other (please specify)

How many times PER WEEK do you have a LATE NIGHT snack between 11 pm and 5 am?

- ☐ Never
 ☐ Often (4-6x/week)
 ☐ Sometimes (1-3x/week)
 ☐ Every day

What do you usually snack on between 11 pm and 5 am? Check all that apply

- ☐ Bagged snacks (e.g. chips, pretzels)
 ☐ Fast foods (e.g. pizza, sandwich, hamburger)
 ☐ Chocolate/candy
 ☐ Fresh or dried fruits
 ☐ Energy bars
 ☐ Cereal
 ☐ Vegetables
 ☐ Cookies or other baked goods

Other (please specify)

How many people do you USUALLY snack with between 11 pm and 5 am?

- ☐ I typically snack alone
 ☐ 1-2 family members
 ☐ More than 2 family members
 ☐ 1-2 peers/friends
 ☐ More than 2 peers/friends

How would you describe your CURRENT daily intake of WATER?

Note: 1 cup is 8 ounces; one BOTTLE (Aquafina) is typically 16-20 ounces or 2-3 cups.

	How many cups?	What type of water do you drink?
Cups/day	<input type="text"/>	<input type="text"/>

Do you use refillable water bottles?

- ☐ No
 ☐ Yes

How often do you consume the following beverages?

	Times/day
Milk (all types and kinds)	<input type="text"/>
Soy milk	<input type="text"/>
Carbonated soft drinks (e.g. Coke, Sprite)	<input type="text"/>
DIET beverages (diet Coke, Crystal light, sparkling water)	<input type="text"/>
Energy drinks (e.g. Red Bull, Monster)	<input type="text"/>
Electrolyte replacement drinks (e.g. Gatorade, Allsport)	<input type="text"/>
Coffee (All types and kinds, including Starbucks, Peets)	<input type="text"/>
Tea (Any type)	<input type="text"/>
100% fruit/vegetable juice (orange, apple, tomato, V-8)	<input type="text"/>
Jamba juice	<input type="text"/>

How often do you eat the following meals:

	Times/week
Breakfast	<input type="text"/>
Lunch	<input type="text"/>
Dinner	<input type="text"/>

Who do you TYPICALLY eat with?

	I skip the meal	I eat alone	With 1-2 peers/friends	With 1-2 family members	With >2 peers/friends	With >2 family members
Breakfast	☐	☐	☐	☐	☐	☐
Lunch	☐	☐	☐	☐	☐	☐
Dinner	☐	☐	☐	☐	☐	☐

Where do you USUALLY have your weekday meals (Monday-Friday)?

	Off campus (At home or anywhere else off campus)	On campus at the Dining Commons	On campus anywhere other than at the Dining Commons
Breakfast	☐	☐	☐
Lunch	☐	☐	☐
Dinner	☐	☐	☐

Have your dietary habits changed over the past semester?

- ☐ No, I eat pretty much the same this semester compared to last semester
- ☐ Yes, my diet is WORSE now than last semester
- ☐ Yes, my diet is BETTER now than last semester

What is the most significant change in your dietary habits since entering SJSU?

Eating fruits and vegetables _____

	Strongly disagree		Neutral		Strongly Agree
is good for my health	☐	☐	☐	☐	☐
helps me look attractive	☐	☐	☐	☐	☐
gives me more energy	☐	☐	☐	☐	☐
does not make a difference	☐	☐	☐	☐	☐
helps me get better grades	☐	☐	☐	☐	☐
helps me lose or maintain weight	☐	☐	☐	☐	☐

You're almost finished! Thanks for hanging in there!

Please rate the following statements on a scale from "Not at all satisfied" to "Very satisfied"

	I am not at all satisfied		I am neither satisfied nor unsatisfied		I am very satisfied
The quantity of dairy foods I eat	☐	☐	☐	☐	☐
The availability of fruits and vegetables on campus	☐	☐	☐	☐	☐
The quantity of fruits and vegetables I eat	☐	☐	☐	☐	☐
The quantity of water I drink	☐	☐	☐	☐	☐
My current diet and food choices	☐	☐	☐	☐	☐
The availability of drinking water (bottled, water fountains, places to refill bottles) on campus	☐	☐	☐	☐	☐
The availability of snacks on campus	☐	☐	☐	☐	☐
The quantity of snacks I eat	☐	☐	☐	☐	☐
My current body weight	☐	☐	☐	☐	☐
The availability of dairy foods on campus	☐	☐	☐	☐	☐

Please rate the following statements on a scale from "Strongly Disagree" to "Strongly Agree"

	Strongly Disagree		Neutral		Strongly Agree
If I knew that production or transportation of certain foods negatively affects the environment (wastes resources, increases global warming), I would avoid those foods or eat less of them	☐	☐	☐	☐	☐
If the cost of fruits and vegetables on campus is lower, I would eat more fruits and vegetables	☐	☐	☐	☐	☐
If the cost of clean and safe drinking water on campus is lower, I would drink more water	☐	☐	☐	☐	☐
If there is a water station for refilling water bottles on campus, I would drink more water	☐	☐	☐	☐	☐
If I knew that what I eat could prevent disease, I would change my eating habits	☐	☐	☐	☐	☐

Please rate the following statements on a scale from "Strongly Disagree" to "Strongly Agree"

	Strongly Disagree		Neutral		Strongly Agree
It is unnecessary for me to eat fruits and vegetables if I take vitamin supplements	☐	☐	☐	☐	☐
It is unnecessary for me to eat dairy products (e.g. milk, cheese, yogurt)	☐	☐	☐	☐	☐
Drinking juice is just as beneficial as drinking water	☐	☐	☐	☐	☐
Drinking carbonated soft drinks is just as beneficial as drinking water	☐	☐	☐	☐	☐
Drinking caffeinated beverages is just as beneficial as drinking water	☐	☐	☐	☐	☐

Eating dairy products _____

	Strongly disagree		Neutral		Strongly Agree
gives me more energy	☐	☐	☐	☐	☐
does not make a difference	☐	☐	☐	☐	☐
helps me lose or maintain weight	☐	☐	☐	☐	☐
makes me healthier	☐	☐	☐	☐	☐
helps me get better grades	☐	☐	☐	☐	☐
helps me look attractive	☐	☐	☐	☐	☐

Please rate the following from "Not at all important to me" to "Extremely important to me"

	Not at all important to me		Neutral		Extremely important to me
Eating organic food	☐	☐	☐	☐	☐
Avoiding food that is highly processed is	☐	☐	☐	☐	☐
Eating food that does not waste resources is	☐	☐	☐	☐	☐
How food is packaged is	☐	☐	☐	☐	☐
Avoiding foods that involves inhumane treatment of animals is	☐	☐	☐	☐	☐
Where food is grown (local vs far away) is	☐	☐	☐	☐	☐

Of the following people, whose opinions do you value? Please check all that apply.

☐ My parents	☐ My boyfriend/girlfriend/spouse	☐ My college friends
☐ My siblings	☐ My roommate	☐ My RA (resident advisor)
☐ Other family members	☐ My friends from high school	☐ My teachers/ professors

Other (please specify)

People whose opinions are important to me think that _____

	Not at all important		Neutral		Extremely important
eating fruits & vegetables every day is	☐	☐	☐	☐	☐
what I eat is	☐	☐	☐	☐	☐
drinking caffeinated beverages is	☐	☐	☐	☐	☐
drinking water is	☐	☐	☐	☐	☐
how much I weigh is	☐	☐	☐	☐	☐
drinking carbonated soft drinks is	☐	☐	☐	☐	☐
eating dairy products is	☐	☐	☐	☐	☐
watching what and how much to snack on is	☐	☐	☐	☐	☐

If I have more convenient access to ...

	Extremely unlikely		Neutral		Extremely Likely
a refrigerator, I will eat more fruits and vegetables	☐	☐	☐	☐	☐
a refrigerator, I will eat more dairy products	☐	☐	☐	☐	☐
a greater variety of fruits & vegetables on campus, I will eat more of them	☐	☐	☐	☐	☐
clean and safe drinking water on campus, I would drink more water	☐	☐	☐	☐	☐
a greater variety of dairy products on campus, I will eat more of them	☐	☐	☐	☐	☐
a farmers' market on campus, I would eat more fruits and vegetables	☐	☐	☐	☐	☐

If I have more access to _____ I would make different food choices.

	Extremely Unlikely		Neutral		Extremely Likely
nutrition information (e.g. printed material, lectures, on-line, emails)	☐	☐	☐	☐	☐
nutrition counseling (e.g. one on one, group, or Internet)	☐	☐	☐	☐	☐
information on nutritional value of foods (e.g. labeling) at campus food venues	☐	☐	☐	☐	☐

If the following items were less visible/available on campus, I would consume fewer of those items.

	Extremely Unlikely		Neutral		Extremely Likely
Carbonated soft drinks (Coke, Sprite)	☐	☐	☐	☐	☐
Caffeinated beverages (coffee, Red Bull)	☐	☐	☐	☐	☐
"Junk foods"	☐	☐	☐	☐	☐

If the following items were more visible/available on campus, I would consume more of those items.

	Extremely Unlikely		Neutral		Extremely Likely
Vegetarian options	☐	☐	☐	☐	☐
Fruits and vegetables	☐	☐	☐	☐	☐
Ethnically diverse food items	☐	☐	☐	☐	☐

Do you drink alcoholic beverages?

☐ No

☐ Yes

How many alcoholic beverages do you USUALLY consume in a given WEEK?

One drink equals one of the following:

12-ounces of beer OR

8-ounces of malt liquor OR

5-ounces of wine OR

1.5-ounces or a "shot" of 80-proof distilled spirits or liquor (gin, rum, vodka, whiskey, etc.)

Are you currently taking any vitamin or mineral supplements? Please check all that apply

☐ No, I am not currently taking any vitamin or mineral supplements

☐ Yes, I take Vitamin C

☐ Yes, I take Calcium

☐ Yes, I take a multivitamin/mineral supplement (e.g. "One-a-Day")

☐ Yes, I take Vitamin E

Are you a vegetarian?

☐ No

☐ Yes

Do you smoke?

☐ No

☐ Yes

How many cigarettes do you smoke on AVERAGE on a DAILY basis

You're finished! Great job!

Thanks for completing this survey. We will notify all prize winners by email!

Good luck.