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Abstract: University students are overlooked as a nutritionally at-risk population in regards to poor dietary intake, food insecurity, and eating behavior. The purpose of this study was to determine if residence has an impact on university students' diets and dietary practices in addition to which residence type (on-campus, off-campus, or family home) more closely meets dietary recommendations established by the US Department of Agriculture. An online Qualtrics survey was designed and distributed to University of Northern Colorado undergraduate students. Results concluded there were few yet impressionable dietary differences according to residence type which could contribute to nutrition-related health risks.

Keywords: *college students, eating behavior, nutrition, residency*

Nearly two-thirds of annual deaths in the United States (U.S.) are nutrition related. Among the 10 leading causes of death, five have been associated with dietary excess and imbalance (USDHHS, 1988). In light of these findings, researchers have sought the most effective ways to prevent dietary excess and imbalance, thereby preventing nutrition related death. While once a common belief that nutrition related conditions, such as heart disease, were contracted during adulthood, overwhelming evidence now suggests lifestyle and dietary habits throughout the lifespan contribute to the risk of developing nutrition-related conditions (WHO, 2000).

Lifestyle development during the typical undergraduate student ages (18 to 25 years) is crucial for establishing healthful, lifelong dietary habits because college typically is the first time young adults live on their own. Within this age range, chronic disease factors begin to manifest themselves as a consequence of poor dietary habits (Brunt & Rhee, 2008). Disease factors have the potential to place individuals at future risk of chronic health conditions, especially diabetes mellitus, heart disease, and cancer (Brevard & Ricketts, 1996; Brown, Dresen, & Eggett, 2005; Nelson, Larson, Barr-Anderson, Neumark-Srtainer, & Story, 2009; Racette, Deusinger, Strube, Highstein, & Deusinger, 2008). Despite this knowledge, nutrition-related conditions, like obesity, are experiencing increasing prevalence rates within the university population (Guo, Roche, Chumlea, Gardner, & Siervogel, 1994). Approximately 70% of students gain an average of 9 pounds ($P < .001$) of weight from beginning of freshman year to the end of sophomore year and steadily gain small amounts of weight each subsequent school year (Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). Evidence suggests a patterned decline in physical activity and adherence to poor dietary habits during undergraduate study are placing the student population at risk of chronic disease (Hoffman, Policastro, Quick, & Soo-Kyung, 2006).

University students are overlooked as a nutritionally at-risk population; however, previous research has produced thought-provoking results about the typical student diet. As a subgroup of young adults, undergraduate students do not meet dietary recommendations developed by the United States Department of Agriculture (USDA) and have a high prevalence of excessive alcohol consumption (Beerman, Jennings, & Crawford, 1990; Brevard & Ricketts, 1996; Brunt & Rhee, 2008; Gaines, Knol, Robb, & Sickler, 2012; Hiza & Gerrior, 2002; Racette et al., 2005, 2008). Current research is focused on identifying lifestyle factors that may contribute to the establishment of poor dietary habits among the population. Lifestyle factors such as occupation, physical activity, preferred foods, courses of study, and gender have been examined by researchers in the past to create effective

intervention strategies. A scarcity of studies address the effect of student residence on dietary intake and the associated lifestyle factors that contribute to poor diet quality. This research was designed to determine if residence has an impact on students' dietary intake and investigate the socioeconomic and behavioral reasoning as to why university students do not meet dietary recommendations.

The purpose of this research was to evaluate how student residence influenced diet and diet practices among a sample of University of Northern Colorado (UNC) students. This study used a cross-sectional design administered as an online *Qualtrics* survey to compare dietary intake, food insecurity, and eating behavior between undergraduate students classified as living on-campus (residence halls), off-campus (apartments, houses, and Greek housing), or at home with parents or relatives (family homes). Data comparisons were made between each residence classification, gender, using the Dietary Guidelines for Americans 2010 (USDHHS, 2010). The Dietary Guidelines for Americans 2010 (DGA 2010) are scientifically developed nutrition guidelines and policy basis for all federal nutrition programs established by the United States Department of Agriculture (USDA) and acted as the control in the study (WHO, 2000). The data collected were used to determine whether significant differences in the variables exist between UNC students who live on-campus, off-campus, or at home and which residence type met standardized nutrition recommendations more closely. Dietary recommendations for this university student population were established, then findings from the students' reported diets were compared to those recommendations.

This study was significant in regards to recent changes made to the DGA 2010. In 2010, the USDA dropped the MyPyramid nutrition guide and established ChooseMyPlate.gov as the new standardized nutrition icon available to the public. Because the change was fairly recent, this study may be among the first to use the new ChooseMyPlate.gov guidelines to measure dietary intake with its food groupings and recommended amounts per day. Findings from this research could be used by the UNC community to implement nutrition programs and interventions for students. The study also addressed knowledge gaps about the relationship between student residence and dietary intake, food insecurity, and eating behavior. Aside from incorporating newly updated nutrition guidelines, this study had an innovative approach because of its unique combination of data collection methods commonly used in nutrition and dietetics.

Recommended Dietary Intake for University Students

In 1980, an expert panel developed the first version of the Dietary Guidelines for Americans (DGA). The DGA have made scientifically developed recommendations for various food groups, macronutrients (total energy, carbohydrate, protein, fatty acids, and cholesterol), and micronutrients (vitamins and minerals) according to age group for the general public (USDHHS, 1988). Since the original guidelines were published in 1980, expert panels have continued to update them every five years. The most recent version, the DGA 2010, are the policy basis for the United States Department of Health and Human Services (USDHHS) and the reference index for ChooseMyPlate.gov, which is the new diet icon associated with the guidelines (USDHHS, 2010; USDHHS & USDA, 2010). Daily recommendations for college students, age 18 to 30 years, are listed on both the digital version of the DGA 2010 available online at DietaryGuidelines.gov and the ChooseMyPlate.gov websites (USDHHS & USDA, 2010). Table 1 shows the current daily food group recommendations that are likely to fulfill macronutrient and micronutrient needs for male and female college students of traditional age (18-30 years) according to the DGA 2010.

Improvements to the DGA 2010 included more applicable food groups than previous versions, establishing recommendations for healthful eating, and quantifying serving sizes; however, food types and their amounts used as guidelines have implied conditions. For instance,

one cup of fruit can be a cup of cut fruit, the equivalent size of one piece of fruit (such as a large orange or a one-inch thick wedge of watermelon) or 100% fruit juice. The measured amount of one cup of vegetables is dependent on whether they are cooked or raw. At least half of grains consumed in one day are recommended to be whole grain and dairy products are recommended to be low fat or fat free. Although oils are not actually a food group, they are included in recommendations because they are excellent sources of essential fatty acids and vitamin E. Furthermore, solid fats (such as saturated fat and partially hydrogenated fat) should consist of less than 10% of recommended daily calories to promote heart health and prevent conditions such as atherosclerosis (USDHHS & USDA, 2010). Minimal nutrition research uses the updated DGA 2010 and its improved food groupings and serving sizes as a means of measuring dietary intake, especially that of a university student population.

Table 1
Recommended Daily Amounts According to Food Group*

Food Group	Recommended Daily Amount for Males (18-30 yrs)	Recommended Daily Amount for Females (18-30 yrs)
Fruits	2 cups	2 cups
Vegetables	3 cups	2 ½ cups
Grains	8 ounces	6 ounces
Protein	6 ½ ounces	5 ½ ounces
Dairy	3 cups	3 cups
Oils	< 7 teaspoons	< 6 teaspoons
Alcohol	< 2 drinks	< 1 drink

*These recommendations are appropriate for a healthy adult who participates in less than 30 minutes per day of moderate physical activity, beyond normal daily activities.

Dietary Intake Data for University Students

Prior study results indicated the majority of the university student population did not consume dietary intakes recommended by the DGA, prior versions of the DGA, or their international equivalents. In 2000, Soriano et al. found Spanish university students both exceeded and inadequately consumed recommended amounts of certain foods when they compared macronutrient and micronutrient intake data from university students to the Spanish Recommended Intake (SRI). Of the 4,000 student participants who submitted 24-hour dietary recalls, most consumed fat and protein amounts well above the recommendation but inadequate amounts of iron and carbohydrate. These researchers determined the university student population may have met the recommendations of one nutrient component but were simultaneously deficient and excessive in consumption of other nutrient components (Soriano, Moltó, & Mañes, 2000).

Researchers in the U.S. have investigated possible reasoning as to why university students stray from dietary recommendations. Hiza & Gerrior (2002) used the Healthy Eating Index (HEI), developed by the USDA, to evaluate the overall diet of college students. On average, students in this study did not meet the maximum

recommended serving of any of the five major food groups of the former Food Guide Pyramid.

Results have revealed multiple reasons for deviations and the authors warned that the university student population is at risk of maintaining poor dietary intake throughout adulthood, which can lead to chronic disease. Racette et al. (2008) published a longitudinal study at a private university in Missouri, one of the few that analyzed an American university student population. The purpose of this study was to assess changes in body weight and BMI of 138 female and 66 male university students from the beginning of freshman year to the end of senior year. They found the overall obesity prevalence had increased by 8% within the first two years (an average of 5.51 to 11.02 pounds gained) though it decreased (to 0.9 to 2.3 pounds) each subsequent year. The level of intensive physical activity modestly decreased ($P < .05$), as did the amounts of fruits and vegetables regularly consumed by both male and female university students ($P < .001$). Limitations to this research were only the students' fruit and vegetable intakes were analyzed and the recommendation reference was the 5-A-Day Campaign developed in 1994, which encouraged the U.S. population as a whole to eat at least five fruits and vegetables daily (Havas & Heimendinger, 1994). The authors suggested further implications of study may exist regarding the students' residence types and how that demographic could have impacted their findings. However, evidence exists that the quality of dietary intake decreases as students grow older, which could carry over to life after university.

Other researchers found deviations in recommended dietary intake that correlated with different gender types. Researchers in New Zealand examined 3-day food diaries and biochemical data submitted by university students. Even though diets for males and females were particularly high in saturated fat, they concluded male university students ate diets deficient in macronutrients, and female students were more likely to have micronutrient deficiencies. Biochemical data, however, suggested no immediate micronutrient deficiency risks among young women (Horwath, 1991); therefore, their diet was of better quality than males. In a similar study, Satalic et al. (2007) found Croatian university students were consuming more total calories and protein than what was recommended by the 2002 U.S. Institute of Medicine's dietary reference intakes. They determined females had better macronutrient consumption but poorer micronutrient consumption. While the findings from these two prior studies are relatable in topic, they were conducted outside of the U.S. Hence, the participants may not have consumed regional foods, which are regularly consumed by American university students. The dietary recommendations used were not designed for the American public, and were outdated. These studies, however, agree with the peer-reviewed knowledge that few university students consume foods in accordance with established dietary recommendations and females have a tendency to consume diets which more closely resemble established dietary recommendations (Kant, 2004).

Researchers in the United Kingdom (U.K.) have attempted to discover patterns of deviation from dietary recommendations according to the course of study university students pursue. Shah et al. performed 30-minute structured interviews, collected 7-day weighed food diaries, and anthropometric values (height, weight, and waist circumference) from 4,000 university students (2011). Statistically, no significant difference in dietary behavior were found between students who studied health-related courses and those who studied non-health related courses; but, the former students ate more fruits and vegetables and had smaller waist circumference measurements. Overall, students were not meeting dietary recommendations. The authors suggested the school promote fruit and vegetable consumption among university students in pursuit of a non-health degree. These researchers used updated, 2010 dietary recommendations from the U.K., which were similar to American recommendations, as a reference to measure adequacy. However, the same inconsistencies within data and references exist between studies

conducted in the U.S. and studies such as this one which are done overseas.

Significance of Residence Type on Healthful Eating

Results of recent literature have been mixed as to whether student residence type has an impact on dietary intakes, food insecurity, and eating behavior. Students classified as living on-campus lived in campus residence halls, off-campus students lived in apartments, houses, or Greek housing, and students who lived at their family home lived with family members. Most studies test whether a statistically significant difference between the different residence types exist. Brevard and Ricketts (1996) compared the dietary intake, physical activity, and blood serum lipid levels of university students who lived on-campus and off-campus. They found more protein was consumed by off-campus students than on-campus students and that physical activity and serum lipid levels were similar between the groups. Brunt & Rhee (2008) analyzed the differences in dietary variety and BMI and how they are related to living arrangements in a typical U.S. university. They found students who lived off campus were more likely to develop health risks as they reported having a larger BMI, less diet variety (especially of fruits and vegetables), and participated more frequently in unhealthful activities like excessive alcohol intake and smoking. These studies focused more on discovering disparities between the two types of student residences rather than the behavioral and cultural reasoning as to why off campus students were at greater risk.

Beerman et al. (1990) discovered differences in food choice and dietary practices among students who lived on-campus, off-campus, and in Greek university housing. From a sample of 250 students, they found significant differences in frequency of 8 of the 27 food items listed on their questionnaire that showed off-campus students drank more beer and ate smaller amounts of fruit and vegetables than on-campus students. They also discovered significant differences between men and women's food choices. The students were from an American university; however the study was conducted over 20 years ago. Page and O'Hagerty (2006) found consistently greater risks for heavy drinking and nutritional problems among members of fraternities and sororities than among students in different accommodations. A study limitation was freshmen students were overrepresented in their sample population.

University Student Food Insecurity and Residence Issues

Food insecurity is a "limited or uncertain availability of nutritionally adequate and safe foods", a condition resulting from financial resource constraints including geographical differences in the cost of food and housing (Bickel, Nord, Price, Hamilton, & Cook, 2000). According to researchers Gaines et al. (2012), university students were likely to be food insecure or at least at risk of food insecurity because they were not experienced with financial management, lacked food preparation skills and preservation knowledge, had less time to earn money, and were often ineligible for federal food assistance programs. They found that although the majority of the University of Alabama student population (64.1%) was food secure, approximately 21.2%, 9.1% and 5.7% of students were classified as marginally food secure, low food secure, and very low food secure, respectively. They further investigated if students' perceptions of cooking skill and using resources affected their food security, but did not directly assess how residence type could influence cooking skill and using resources. This is terrific baseline data that demonstrates how university students fare within their population; however implications, such as residence type, were not addressed in the study.

Chaparro et al. (2009) investigated the prevalence of food insecurity among University of Hawaii at Manoa (UHM) students to determine which students, if any, were at increased risk of suffering from food insecurity. Approximately 21% of 441 UHM students surveyed were food-insecure, 15% were classified as having low food security, and 6% having very low food security. One in four students (24%) reported having one or

two indicators of food insecurity, classifying them as marginally food-secure or at risk of food insecurity. The prevalence of food insecurity among UHM students was nearly three times that reported by the US Department of Agriculture (USDA) for the state of Hawaii for the years 2004–2006. They also found that students who lived on campus, off-campus but did not specify their living arrangement (off-campus unknown), or off-campus with roommates were more likely to be food insecure than students living within their family home. Though the results from this study are insightful, more research-based evidence is needed from universities throughout the nation to determine how specific types of student residences affect food availability.

Eating Behavior and University Student Residence

Arguably, eating behavior is one of the least studied contributions to university students' inadequate dietary intake as a population. Eating behavior is difficult to study due to the amount of content and its diversity among populations. Yet, as a culture itself, the university student population has long been rumored to have a plethora of eating behavior issues. Eating behavior is heavily influenced by whether students have a prepaid meal plan through their university's dining services. Research at Brigham Young University by Brown et al. (2005) compared students' food group intakes to calculated, estimated energy requirements (EER) according to participation in a campus prepaid meal plan and residence type. Participants' (N=503) ages ranged was from 18 to 29 years. Overall, students fell short of the dietary recommendations. In regards to fruit, vegetable, dairy, and meat food groups, students with the campus meal plan came closer to meeting the recommendations than students without. Interestingly, students without the meal plan were closer to meeting the recommendations of the grain food group than students with the plan. An overwhelming majority of students who had the meal plan (93 of the 94 students) lived in residence halls therefore, on-campus students had better dietary intake.

These results were acceptable because expensive, perishable foods such as fruits, vegetables, dairy, and meat were readily available to students with a meal plan and difficult to purchase and store for students without a meal plan or live in unaccommodating residences (Brown et al., 2005). A similar study by Brevard & Ricketts (1996) had conflicting findings in that students in Greek housing generally had the best nutrient and food group intakes. Both studies used the Food Guide Pyramid as a dietary reference index, which has been replaced by ChooseMyPlate.gov in 2010; results from our study may be different from one or the other due to updated recommendations.

The influence of student residence on the frequency of skipping meals and snack patterns has been studied. Research by Choi & Lee (2012) sought to link college students' residences to frequency of meal skipping and snacking pattern. Participants consisted of 219 university students classified as living on-campus or off-campus who were given a self-administered survey. Approximately 67% of the participants reported skipping a meal within a one week time period, but there were no significant differences between on-campus and off-campus variables. Of the participants who stated they had skipped a meal within one week, "No time to prepare" was the dominant reason for such behavior. Though Choi & Lee's results indicated students living off-campus selected sweet food items more as a snack, statistical results showed that students' residence type did not influence snacking pattern either. A lack of research supports or rejects the hypothesis that residence type has an impact on meal skipping and snack pattern in the university student population, which will be included in this study.

METHODS

This study was approved by the UNC Internal Review Board. Survey reliability and validity were tested using responses from upper-level nutrition/dietetic majors and non-majors. Online software, *Qualtrics*, was used to create a survey, which included a 24-hour dietary recall-styled

FFQ, the U.S. Adult Food Security Survey Module (AFSSM), and behavioral questions relating to diet. An estimated sample size of 300 male and female participants was used commonly in literature; therefore, the recruitment goal was 300 UNC students, ages 18-30 years. Recruitment took place by random selection of courses in which instructors were contacted by an email requesting assistance in distribution of the online survey by posting a link to the class announcement section on Blackboard. Participants did not come from any known vulnerable population. Recruitment began in April of 2013. Data collection took place for one month. Time required to complete the survey was estimated to take no longer than 40 minutes. Participants were asked to gain internet access (whether at home or at school) and direct themselves to the survey from their course's Blackboard announcement page.

Survey and Data Collection

Participants answered demographic questions and whether they lived on-campus, off-campus, or at their family home. The first section of the survey consisted of a food frequency questionnaire (FFQ) developed specifically for this study. To complete the FFQ, participants were instructed to select the amount of a listed food item they had consumed within the past 24 hours. Food items were listed along with the amount which consists of one serving size according to ChooseMyPlate.gov recommendations. Participants were instructed to select the frequency of the listed amounts ranging from "not at all" to "five or more times". These data were used to calculate a total sum of servings within the specified food group.

The next portion of the survey consisted of the U.S. Adult Food Security Survey Module (AFSSM), which is a shortened version of the U.S. Household Food Security Survey Module (HFSSM) specifically for households without children. The AFSSM is used by public health organizations to measure the food security status of a population (USDA, 2012). It consists of 10 multiple choice questions; each question inquires about conditions that are characteristic to households with difficulty meeting basic food needs and have occurred within the past 12 months. AFSSM results were configured by summing positive responses and sorting the results into four food security categories: high food security, marginal food security, low food security, and very low food security (Table 2). Responses such as "yes", "often", "sometimes", "almost every month", and "some months but not every month" were coded as affirmative. The sum of affirmative responses to the 10 questions in the AFSSM was the household's raw score.

Table 2
AFSSM Scoring Scale

Raw Score	Food Security Level (Among Adults)
0	High Food Security
1-2	Marginal Food Security
3-5	Low Food Security
6-10	Very Low Food Security

The AFSSM offers advantages as a food security screening tool as it places little to no burden on survey takers and is statistically comparative to HFSSM which involves households with children (Bickel et al., 2000). After taking the web-based survey, participants were finished with the research process.

Once collected, data were analyzed comparatively. The amount of listed foods provided in the FFQ portion was equal to one serving of a specific food group based on ChooseMyPlate.gov. *Qualtrics* software was programmed to multiply the serving by the amount the participant selected and add those

together to form the total servings of a specific food group (i.e. grains, fruits, vegetables, protein, dairy, etc.).

Data collected from *Qualtrics* software were transferred to Microsoft Excel for organization and calculations, then imported to IBM SPSS Software for analysis. Individual responses were grouped into three independent variables according to their residence (on-campus, off-campus, and family home) and the average number of servings of a food group per residence type were calculated. Descriptive statistics from eating behavior questions were included in the data set used for statistical analysis. Individually listed food items on the FFQ were not measured to avoid skewed statistical data related to behavioral variability.

Reliability and Validity Testing

Reliability was tested using a 2-tailed paired, samples t-test using data consisting of an original test and retest, collected from non-nutrition/dietetic majors (non-majors) during a preliminary survey launch. Paired samples were tabulated by IBM SPSS. Upper-level nutrition/dietetic majors (from a separate course) completed the survey before it was launched to provide data for discriminate validity testing. The mean differences of each question answered by upper-level nutrition/dietetics majors and non-majors were comparatively analyzed using independent t-test for equality of means.

Data Analysis

Complete responses were analyzed statistically using a one-way ANOVA and Tukey honestly significant difference (HSD) post hoc test (significance level at $P < .05$). Differences in dietary intake (by servings per food group) were compared between residence types. The total servings for each food group were descriptively compared to ChooseMyPlate.gov recommendations and to the other residence types.

RESULTS

The paired samples correlation measured significant reliability correlations (N=11, Males (M) = 2, Females (F) = 9; $P < .05$) between test samples in eight survey questions (Table 3). Raw scores from the AFSSM survey (correlation coefficient = .95; $P < .001$) were reliable between the first test and subsequent retest for food insecurity. Milk type (correlation coefficient = .98; $P <.001$) and grocery shopping frequency (correlation coefficient = .93; $P < .001$) were reliable. Behavioral questions such as time spent preparing meals, snack substitution for meals, access to kitchen facilities, eating environment, and number of work hours per week were also statistically reliable ($P < .05$) as shown in Table 3. Further analysis of paired differences in means concluded the means between test and retest were significantly different for grains ($P = .04$), protein ($P = .01$), and food insecurity ($P= .02$).

Although the AFFSM and various behavioral questions were significantly reliable, questions from the FFQ portion of the survey were not reliable ($P > .05$) in addition to the question assessing what percentage of grains consumed are whole grain. As for validity testing (N=13, M=2, F=11), the only significant differences between upper-level nutrition/dietetics majors and non-majors were for questions about the percentage of whole grains ($P < .003$) and milk type ($P < .048$). Age was almost significantly different ($P= .060$). Otherwise, there was no discrimination between nutrition/dietetics majors and non-majors (Appendix, Table A-1).

The sample size for the main research component consisted of 62 undergraduate students. The ANOVA analysis (Appendix, Table A-2) indicated there were no significant differences between the residence types except for three behavioral questions. Grocery shopping frequency ($P = .00$), time spent preparing meals ($P = .00$), and number of work hours per week ($P = .03$) were statistically different according to residence type. Interestingly, the FFQ question about fats and oils intake ($P = .059$) was close to significance in addition to the behavioral question about snack substitution for meals ($P = .07$).

Table 3
Results of Paired Samples Test for Reliability

Variable	N	Correlation coefficient	P-Value (Correlation Coefficient)	Paired Difference in means (sd)	t	P-Value (Paired Differences)
Grains-sum	11	.11	.75	3.09 (±4.36)	2.35	**.04**
Fruit-sum	11	.25	.46	.18 (±2.28)	2.64	.80
Vegetable-sum	11	.06	.86	.55 (± 2.32)	.78	.45
Protein	11	.11	.74	3.41 (± 3.77)	3.00	**.01**
Dairy	11	.24	.48	.32 (± 2.00)	.53	.61
Fats	11	.13	.70	.86 (± 6.06)	.47	.65
Food insecurity	11	.95	**.00**	.91 (± 1.04)	2.89	**.02**
Whole grain %	11	.36	.27	.36 (± 1.12)	1.07	.31
Milk type	11	.98	**.00**	-.09 (± 1.04)	-1.00	.34
Grocery Shopping	11	.93	**.00**	.00 (± .45)	.00	1.0
Prep time	11	.76	**.01**	-.28 (± .79)	-1.15	.28
Snack Substitute	11	.68	**.02**	-.28 (± .79)	-1.15	.28
Kitchen		*	*	.09 (± .30)	1.00	.341
Environment	11	.83	**.00**	.36 (± .92)	1.3	.22
Time b/t Meals	11	.43	.18	.18 (± 1.3)	.48	.64
Work hours	6	.92	**.01**	.17 (± .41)	1.00	.36
Age	11	.99	.000	-.10 (± .30)	-1.00	.34

*No correlation coefficient or P value

Off-campus females were less likely to eat adequate servings of grain foods (5.38 servings) per day than ChooseMyPlate.gov recommendations (6 servings). On average, students consumed more than the recommended daily servings of fruit, regardless of living situation. Both male and female students consumed at least half of one serving more than the recommended amount of vegetable servings per day. Off-campus females consumed vegetables in amounts (3.42 servings) that were closer to the recommendation (2.5 servings) than any other subgroup. Daily protein intake was consumed in amounts beyond the recommendation, especially by off-campus males. Off-campus male and female students did not consume the recommended amount of dairy servings, nor did female students living in a family home.

Students who lived in family homes consumed the most servings of fats and oils per day. On-campus males and females were least likely to meet the recommendation to make 50 percent of grain foods whole grain. On average, males deviated approximately 7 servings total from ChooseMyPlate.gov recommendations, whereas females deviated around 4 servings. According to descriptive percentages, on-campus students deviated from ChooseMyPlate.gov recommendations the least than any other residence type. Tukey's HSD post hoc test identified a notable difference (P = .059) in fats and oils food group intake between off-campus students and students who lived in a family home. Students who lived in family homes consumed approximately one serving more than off-campus students and the most fats and oils of the residence types. Among all participants, the total mean score for affirmative responses on the AFSSM food security survey was 2.85, which is

borderline marginally food secure and low food secure.

Table 4
Comparisons of Daily Dietary Intake Means

	ChooseMyPlate.gov Recommendations		Residence On-Campus	Off-Campus (Apartment/House/Greek)			Off-Campus (Family Home)
	M	F	Total	M	F	Total	Total
N			24	8	24	32	6
Grain Servings Mean (sd)	8.00	6.00	6.69 (±4.75)	8.00 (±4.57)	5.38 (±3.38)	6.03 (±3.81)	7.50 (±3.22)
Fruit Servings Mean (sd)	2.00	2.00	6.21 (±7.78)	3.31 (±4.04)	3.29 (±2.58)	3.30 (±2.94)	2.67 (±.88)
Vegetable Servings Mean (sd)	3.00	2.50	3.52) (±4.61)	4.13 (±2.83)	3.42 (±2.22)	3.59 (±2.36)	4.50 (±2.53)
Protein Servings Mean (sd)	6.50	5.50	6.31 (±4.33)	11.69 (±5.50)	6.27 (±3.14)	7.63 ± (4.45)	9.58 (±3.12)
Dairy Servings Mean (sd)	3.00	3.00	4.60 (±9.23)	2.85 (±2.24)	2.76 (±1.95)	2.78 (±1.99)	2.53 (±1.57)
Fats & Oils Servings Mean (sd)	< 7.00	< 7.00	3.77 (±3.63)	3.31 (±2.59)	2.60 (±1.88)	*2.78 (±2.06)	*5.75 (±3.13)
% Whole Grain Mean (sd)	3.50	3.50	3.04 (±.96)	3.5 (±.76)	3.33 (±1.13)	3.38 (±1.04)	3.83 (±.98)
Milk Type (sd)	3-4	3-4	3.08 (±1.56)	2.00 (±1.20)	3.08 (±1.44)	2.81 (±1.45)	3.33 (±1.03)

*P = .059 based on Tukey HSD post hoc test

Grocery shopping frequency was significantly different (Table 5) between on-campus students and both students who lived in family homes (P = .00) and off-campus students (P = .00). Students who lived in family homes went grocery shopping more often than on-campus students, yet there was no significant difference (P = .10) from off-campus students. There was a significant difference in time spent preparing food between on-campus and off-campus students (P = .00) and students who lived in family homes (P = .02). Snack substitution tended towards differences between on-campus students and off-campus students (P = .07). The number of hours worked per week differed between on-campus students and off-campus students. Though it was not

significant (P > .05), the difference of the means for BMI were highest among students living in family homes and the lowest was among on-campus students.

Table 5
Significant Tukey HSD Post Hoc Findings for Behavioral Questions

Dependent Variable	Residence Type	Residence Type Comparisons	Mean Difference	Significance (P < .05)
Grocery Shopping Frequency	On-Campus	Off-Campus (Apt/House/Greek)	±1.09	.00
		Off- Campus (Family Home)	±1.92	.00
Preparation Time	On-Campus	Off-Campus (Apt/House/Greek)	±1.00	.00
		Off- Campus (Family Home)	±.88	.02
Snack Substitution	On-Campus	Off-Campus (Apt/House/Greek)	±.59	.07
Work Hours per Week	On-Campus	Off-Campus (Apt/House/Greek)	±.95	.02

DISCUSSION

Dietary Intake

In theory, the FFQ portion of the survey was capable of measuring the amount of foods consumed within 24-hours by number of servings eaten per food group. According to the paired samples t-test correlation however, there were statistical differences (P < .05) between the grains and protein food group FFQ questions in addition to food insecurity (P = .02) between the test and retest sessions by non-nutrition/dietetics majors (Table 3). One factor that may have influenced lack of reliability was the timing of the year in which the preliminary survey was administered; students were on spring break during data collection. Potentially, the temporary change of residence during this time could alter the participant's perception of food insecurity and the FFQ could represent a residence type other than typical undergraduate housing. Seven questions did not have correlation coefficients of high significance (correlation coefficient > 0.7) which could have resulted from poor question wording and insufficient small sample size.

Percentage of grains which are whole grain and milk type were the only variables that were significantly different between upper-level nutrition/dietetics majors and non-majors within the results from discriminate validity testing. Upper-level nutrition/dietetics majors were statistically one point higher than non-majors for the scoring which represented consumption of whole grains. Because the scoring was set at intervals of 25, upper-level nutrition/dietetics majors consumed 25% more whole grains than non-majors per day. Nutrition/dietetics majors consumed about 25% more low fat dairy (Appendix, A-1). Shah et al. (2011) found statistically significant differences in waist circumference, fruit, and vegetable consumption between students who studied health-related courses and those who studied non-health related courses. Similarly, this study found upper-level nutrition/dietetics majors consumed more whole grains in the recommended amount (50% of grain foods to be whole grains) and low fat or fat free dairy products than non-majors.

Food Security

The total mean score for affirmative responses on the AFSSM food security survey indicated a

borderline marginally food secure and low food secure score among undergraduate students as a whole. This evidence supports findings from Chaparro et al. and Gaines et al. (2009; 2012) which concluded university students as a population are at risk of food insecurity or are food insecure. There were no significant differences between residence types in regards to food insecurity. Future implications of study should include a larger sample size to detect significant differences between residence types.

Eating Behavior

The general ANOVA analysis concluded grocery shopping frequency (P = .00), time spent preparing meals (P = .00), and number of work hours per week (P = .03) were statistically different according to residence type, all of which were anticipated. Grocery shopping frequency was anticipated to be different between residence types (mostly between on-campus and off-campus students in general) because students who lived on-campus were more likely to use UNC's meal plan, decreasing the need to constantly purchase food from the grocery store. For similar reasons, time spent preparing meals was anticipated to be different between residence type. Interestingly, questions about access to kitchens and kitchen equipment were not significantly different between residence type, which indicates most of UNC's on-campus residence halls provide residents with access to kitchens and kitchen equipment. This finding suggests the differences in grocery shopping frequency and time spent preparing meals may have been behavioral rather than circumstantial. The number of work hours, and time spent preparing meals were anticipated to be different between residence type due to financial strains which accompany living off-campus (paying rent, home maintenance, monthly bills, etc.) and age progression (decreased financial assistance from family members).

Further investigation of the ANOVA analysis using Tukey's HSD post hoc tests showed differences between the three residence types in greater detail. Grocery shopping frequency was significantly different (Table 5) between on-campus students and both off-campus students and students who lived with family. There was no significant difference between off-campus students and students who lived in family homes. This finding was likely a result of the use of UNC's meal plan among students living on-campus. Surprisingly, students who lived off-campus went grocery shopping within similar frequencies of students living in family homes; however, the amount of food purchased each shopping trip and for how many people could vary. The amount of time spent preparing food was significantly different between on-campus students and both off-campus students and students who lived in family homes, just as grocery shopping frequency, there was no difference between off-campus students and students who lived in family homes for corresponding reasons.

Unlike findings from Choi & Lee (2012), off-campus students at UNC were significantly more likely to substitute snacks for meals than on-campus students. Off-campus students, though not significant, used UNC's meal plan less than on-campus students and likely did not benefit from sharing meals between family members as students who lived in family homes typically would. Off-campus students worked significantly more hours per week than on-campus students, alluding to a potential increased need for students to earn money in order to afford off-campus housing.

Though the significant differences found between residence types were somewhat predictable, certain properties that were not significantly different were fascinating. For instance, the FFQ (though not statistically reliable) indicated no difference in dietary intake among the residence types although, the fats and oils food group was close (P= .059) to having significant difference between both off-campus students and students who lived in family homes. Future implications for study would be to utilize a larger sample size in order to ascertain these findings. There were no significant differences among the residence types in BMI; however, according to the differences of means, off-campus

students who lived in family homes had the highest BMI values, followed by off-campus students, and on-campus students respectively. Age progression could be a factor within this finding, among additional behavioral questions which could be further explored in future studies.

The descriptive analysis of average daily intakes according to residence type yielded interesting trends among the student population when compared to ChooseMyPlate.gov recommendations. Descriptive comparisons to recommendations were generalized on account of the small sample size preventing proper comparisons of means (N= 1 for male on-campus and off-campus participants). Racette et al. (2008) determined fruit consumption decreased as students aged. According to the descriptive comparisons of this study, average fruit intake decreased with on-campus students eating the most total servings per day, and students living in family homes eating the least total servings. As the majority of students living in family homes are 25 years or older, decreased fruit consumption could very well be linked to both residence type and age progression.

Much like the studies analyzing differences in gender (Horwath, 1991; Satalic et al., 2007), descriptive statistics indicated females seemed to eat diets that, based on average servings, met ChooseMyPlate.gov recommendations more closely than males. Satalic et al. (2007) found Croatian students were consuming more protein than the 2002 U.S. Institute of Medicine recommendation and Brevard & Ricketts (1996) found more protein was consumed by off-campus students than on-campus students. A similar trend was found among U.S. students in this study, as off-campus males consumed almost double the recommended amount of daily protein.

Limitations

Four responses were eliminated from results because they did not answer the majority of the questions for unexplained reasons and could not be categorized by residence type. The original survey was designed to include Greek housing as its own residence type; however, one participant represented Greek housing which did not quantify enough responses to stand alone. Therefore, the Greek housing data were collapsed to the off-campus residence type (apartments, houses, and Greek housing). Tukey's HSD post hoc was used because the data groupings (by residence type) were not homogenous.

The most profound limitations to this study were the small sample of student participants and lack of reliable survey questions. A larger sample size for reliability testing and the primary study may have yielded different results. Additional limitations were related to the use of self-reported data. Per the University of Northern Colorado's Internal Review Board, anonymity and confidentiality were protected by the researchers to the best of their ability. Despite this effort, potential embarrassment from self-reporting information such as anthropometrics (height and weight), dietary intake, and food insecurity could have influence over the amount of underreported data. Participant misinterpretation of survey questions and miscalculation of portion sizes on the FFQ portion of the survey were also possible. One documented limitation to using the AFSSM to assess food insecurity was the fact its generated data are restricted to adult participants only, meaning food security of children or other family members in a household is not evaluated (Bickel et al., 2000).

CONCLUSION

The findings of this study were heavily influenced by the use of campus dining services as UNC freshmen were required to purchase meal plans should they live on-campus and the same was recommended for non-freshmen students who live on-campus. The availability of food and associated eating behavior from using the meal plan impacted all three implications of this study. The lack of reliable questions and a statistically adequate sample size caused difficulties in assessing significant differences in dietary intake according to residence type. Though undergraduate students who participated in the study, on average, scored between marginally food secure and low food secure on the AFFSM,

there were no significant differences in food insecurity according to residence type. Behaviors such as grocery shopping frequency, time spent preparing meals, and number of work hours per week were statistically different according to residence type; all of which have implications on student lifestyle and dietary habits. On the basis of this study, residence type did have an impact on eating behaviors and could very well have an impact on dietary intake and food security should future, related studies adjust question wording and acquire a sufficient sample size.

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APPENDIX

Table A-1
Validity: Independent Samples T-Test Summary

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Grains-sum-TEST	Equal variances assumed	-.088	38	.930	-.1510	1.7176	-3.6282	3.3262
	Equal variances not assumed	-.075	16.733	.941	-.1510	2.0102	-4.3973	4.0954
Fruit-sum-TEST	Equal variances assumed	-1.653	38	.107	-3.1567	1.9102	-7.0236	.7102
	Equal variances not assumed	-1.216	13.147	.245	-3.1567	2.5953	-8.7570	2.4436
Vegetables-sum-TEST	Equal variances assumed	-1.741	38	.090	-5.3020	3.0462	-11.4686	.8646
	Equal variances not assumed	-1.216	12.307	.247	-5.3020	4.3585	-14.7722	4.1682
ProteinTEST	Equal variances assumed	-1.009	38	.319	-2.2379	2.2184	-6.7288	2.2530
	Equal variances not assumed	-.777	14.042	.450	-2.2379	2.8784	-8.4097	3.9340
DairyTEST	Equal variances assumed	.183	38	.855	.131140	.714831	-1.315961	1.578240
	Equal variances not assumed	.195	27.775	.847	.131140	.673538	-1.249043	1.511323
Fats_and_OilsTEST	Equal variances assumed	-1.621	38	.113	-1.5670	.9665	-3.5234	.3895
	Equal variances not assumed	-1.613	23.487	.120	-1.5670	.9714	-3.5741	.4402
FoodSecurityTEST	Equal variances assumed	.720	38	.476	.809	1.123	-1.465	3.083
	Equal variances not assumed	.705	22.570	.488	.809	1.147	-1.566	3.184
PercentWholeGrainsTEST	Equal variances assumed	-3.166	37	**.003**	-.962	.304	-1.577	-.346
	Equal variances not assumed	-3.609	33.637	.001	-.962	.266	-1.503	-.420
MilkTypeTEST	Equal variances assumed	-2.042	37	**.048**	-.923	.452	-1.839	-.007
	Equal variances not assumed	-2.255	31.309	.031	-.923	.409	-1.758	-.089
HowOftenShopTEST	Equal variances assumed	-1.420	37	.164	-.500	.352	-1.213	.213
	Equal variances not assumed	-1.415	23.870	.170	-.500	.353	-1.229	.229
TimeSpentPreparingFoodTEST	Equal variances assumed	-.777	37	.442	-.231	.297	-.833	.371
	Equal variances not assumed	-.754	22.287	.459	-.231	.306	-.865	.404
HowOftenSubSnacksTEST	Equal variances assumed	.478	37	.636	.154	.322	-.498	.806
	Equal variances not assumed	.548	34.026	.587	.154	.281	-.417	.725
TimeBetweenMealsTEST	Equal variances assumed	.316	37	.754	.154	.487	-.834	1.141
	Equal variances not assumed	.279	17.883	.783	.154	.551	-1.005	1.312
HoursPerWeekWorkTEST	Equal variances assumed	-1.321	22	.200	-.614	.465	-1.579	.350
	Equal variances not assumed	-1.329	19.951	.199	-.614	.462	-1.579	.350
AgeTEST	Equal variances assumed	-1.939	37	**.060**	-1.538	.793	-3.146	.069
	Equal variances not assumed	-2.147	31.482	.040	-1.538	.717	-2.999	-.078
Height_ft_TEST	Equal variances assumed	.322	24	.750	.042	.132	-.229	.314
	Equal variances not assumed	.330	23.328	.744	.042	.129	-.223	.308
Height_in_TEST	Equal variances assumed	-1.552	24	.134	-2.267	1.461	-5.281	.748
	Equal variances not assumed	-1.580	22.967	.128	-2.267	1.435	-5.235	.701
WeightTEST	Equal variances assumed	1.353	24	.189	18.024	13.319	-9.464	45.513
	Equal variances not assumed	1.481	22.180	.153	18.024	12.169	-7.200	43.249

Table A-2
ANOVA Analysis Summary

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Grains-sum	Between Groups	13.548	2	6.774	.392	.678
	Within Groups	1020.875	59	17.303		
	Total	1034.423	61			
Fruit-sum	Between Groups	135.363	2	67.682	2.399	.100
	Within Groups	1664.221	59	28.207		
	Total	1799.585	61			
Vegetables-sum	Between Groups	4.836	2	2.418	.206	.814
	Within Groups	691.958	59	11.728		
	Total	696.794	61			
Protein-sum	Between Groups	58.063	2	29.031	1.565	.218
	Within Groups	1094.615	59	18.553		
	Total	1152.677	61			
Dairy-sum	Between Groups	50.925	2	25.462	.718	.492
	Within Groups	2093.671	59	35.486		
	Total	2144.596	61			
Fats & Oils-sum	Between Groups	48.522	2	24.261	2.968	.059
	Within Groups	482.333	59	8.175		
	Total	530.855	61			
What percentage of of your grain products (bread, pasta, oatmeal, breakfast cereals, tortillas, etc....	Between Groups	3.483	2	1.741	1.733	.186
	Within Groups	59.292	59	1.005		
	Total	62.774	61			
What type of milk do you typically consume?	Between Groups	1.894	2	.947	.443	.644
	Within Groups	126.042	59	2.136		
	Total	127.935	61			
Food Insecurity-sum	Between Groups	26.641	2	13.321	1.431	.247
	Within Groups	549.052	59	9.306		
	Total	575.694	61			
How often do you go grocery shopping?	Between Groups	25.448	2	12.724	16.301	.000
	Within Groups	46.052	59	.781		
	Total	71.500	61			
On a typical day, how much total time do you spend preparing your own meals (including preparation,...	Between Groups	14.214	2	7.107	14.909	.000
	Within Groups	28.125	59	.477		
	Total	42.339	61			
How often do you substitute snack foods for meals?	Between Groups	5.084	2	2.542	2.747	.072
	Within Groups	54.594	59	.925		
	Total	59.677	61			
On average, how much time do you allow between meals?	Between Groups	2.419	2	1.210	.643	.529
	Within Groups	111.000	59	1.881		
	Total	113.419	61			
How many hours do you work per week?	Between Groups	6.090	2	3.045	3.997	.030
	Within Groups	21.330	28	.762		
	Total	27.419	30			
BMI	Between Groups	172.667	2	86.334	2.062	.138
	Within Groups	2051.473	49	41.867		
	Total	2224.140	51			

Table A-3
Descriptive Data for Dietary Intake

Report

What is your current living situation?		Grains	Fruit	Vegetables	Protein	Dairy	Fats & Oils	Percentage of grain products are whole grain?	Type of milk
On-campus	Mean	6.69	6.21	3.52	6.31	4.60	3.77	3.04	3.08
	N	24	24	24	24	24	24	24	24
	Std. Deviation	4.76	7.78	4.61	4.33	9.23	3.63	.96	1.56
Off-Campus (Apt, House, Greek)	Mean	6.03	3.30	3.60	7.63	2.78	2.78	3.38	2.81
	N	32	32	32	32	32	32	32	32
	Std. Deviation	3.81	2.94	2.36	4.45	1.99	2.06	1.04	1.45
(Off-Campus Family Home	Mean	7.50	2.67	4.50	9.58	2.53	5.75	3.83	3.33
	N	6	6	6	6	6	6	6	6
	Std. Deviation	3.22	.88	2.53	3.12	1.57	3.13	.98	1.03
Total	Mean	6.43	4.36	3.65	7.31	3.46	3.45	3.29	2.97
	N	62	62	62	62	62	62	62	62
	Std. Deviation	4.12	5.43	3.38	4.35	5.93	2.95	1.01	1.45

Table A-4
Descriptive Data for Behavioral Questions

Report

What is your current living situation?		Food Insecurity	What meal plan	Grocery shopping Frequency	Time spent preparing meals	Substitute snack foods for meals	Have a kitchen/ kitchenette	Eating environment	Time between meals	Exercise or play sports regularly	Have a job in addition to attending school	Hours of work per week?	Age	BMI	Gender
On-Campus	Mean	2.50	3.09	1.75	1.13	1.87	1.25	1.92	3.87	1.46	1.54	1.64	2.17	23.67	1.96
	N	24	23	24	24	24	24	24	24	24	24	11	24	22	24
	Std. Deviation	3.04	.90	.74	.34	.85	.44	1.59	1.19	.51	.51	.67	.92	7.16	.20
Off Campus (Apt. House, Greek)	Mean	3.41	4.33	2.84	2.13	2.47	1.03	2.25	4.19	1.38	1.47	2.59	4.34	25.57	1.75
	N	32	9	32	32	32	32	32	32	32	32	17	32	26	32
	Std. Deviation	3.24	1.66	.99	.87	1.02	.18	1.57	1.49	.49	.51	1.00	2.057	5.97	.44
Off Campus (Family Home)	Mean	1.33		3.67	2.00	2.00	1.00	2.33	4.50	1.33	1.50	2.33	7.00	30.63	1.83
	N	6		6	6	6	6	6	6	6	6	3	6	4	6
	Std. Deviation	1.51		.82	.63	1.10	.00	2.07	1.38	.52	.55	.58	2.45	5.28	.41
Total	Mean	2.85	3.44	2.50	1.73	2.19	1.11	2.13	4.10	1.40	1.50	2.23	3.76	25.16	1.84
	N	62	32	62	62	62	62	62	62	62	62	31	62	52	62
	Std. Deviation	3.07	1.27	1.08	.83	.99	.32	1.60	1.36	.50	.50	.96	2.27	6.60	.37