GAVIN PUBLISHERS

Food & Nutrition Journal

Hilliard E, et al. Food Nutr J 1: 116.
DOI: 10.29011/2575-7091.100016

Research Article

Frequency of Dining at Residence Halls and Intake of Fat-Soluble Vitamins among College Students

Elizabeth Hilliard, Ardith Brunt*, Samantha Fuhrmann, Ashley Gehl

Department of Health, Nutrition and Exercise Sciences, North Dakota State University, USA

***Corresponding author:** Ardith Brunt, Department of Health, Nutrition and Exercise Sciences, North Dakota State University, Fargo, ND 58108, USA, Tel: +1 7012317475; Fax: +1 7012317453; E-mail: ardith.brunt@ndsu.edu

Citation: Hilliard E, Brunt A, Fuhrmann S, Gehl A (2016) Frequency of Dining at Residence Halls and Intake of Fat-Soluble Vitamins among College Students. Food Nutr J 1: 116. DOI: 10.29011/2575-7091.100016

Received Date: 27 November, 2016; **Accepted Date:** 10 December, 2016; **Published Date:** 15 December, 2016

Abstract

Objective: To determine if students' gender, age, and number of meals consumed from campus dining halls were associated with fat-soluble vitamin intake.

Participants: 352 students enrolled in wellness courses during spring semester 2014 at a Midwestern university.

Methods: Students reported dining hall usage, and used Nutrition Calc to analyze a self-reported 72-hour food record. Chi square, t-tests, and regression were used to identify associations between fat-soluble vitamin intake and various demographics.

Results: Living situations had a U-shaped association with student's fat-soluble vitamin intake. In general, students never eating on - campus and those eating on campus ≥11 times week were more likely to meet the DRI for fat soluble-vitamins. Those students who ate off campus were most likely to meet the DRI for vitamin E; whereas those who ate on campus were most likely to meet the DRI for vitamin A. Few students met the DRI for Vitamin D.

Introduction

Poor diet has been implicated as a causative factor in multiple chronic diseases including: cardiovascular disease, hypertension, diabetes, cancer, and osteoporosis [1]. Many of these diseases do not manifest until adulthood. However, their nutritional foundation may be laid during childhood, as evidenced by the increasing number of children and adolescents developing risk factors for adult chronic disease.1Eating habits are developed during youth and have a lasting impact on health [1,2]. Therefore, it is imperative that children and young adults develop healthy dietary habits [2].

While eating patterns are established early, there may be times when those habits are subject to change. One example is the transition from high school to college. During this transition, an adolescent transforms from dependent to independent. Nutritionally, this transition is hallmarked by changes in the availability of foods. Adolescents living with their parents are subject to parent control over meals [3]. However, once adolescents leave their parent's home, they become responsible for all food choices [4]. An adolescent who has not learned to enjoy and consume nutrient dense foods may choose foods that are high in sugar and fat with little nutritional value once they leave the home. If these poor choices lead to an increase in weight, BMI, and waist circumference, academic performance may suffer [5]. Additionally, these choices could also lay the foundation for chronic disease.

Consumption of nutrient dense foods has been affected by the availability and convenience of ready-made foods [6]. Convenience, or ready-made foods, includes prepackaged foods, canned or frozen foods [7], and fast foods. Ready-made foods are widely available at convenience stores, grocery stores, campus stores, campus cafeterias, and other vendors. These items require little to no preparation, and often times are lacking in nutrient density [8]. During focus groups, college students have indicated that convenience foods are appealing for many reasons including: time constraints from traveling to school; short breaks between classes; lack of cooking time; lack of cooking skills; and lack of motivation to make meals [8]. The appeal of convenience foods coupled with their lack of nutrient density may be a significant factor in compromising nutrient intake.

Other factors may also contribute to compromised nutrient intake in college aged youth. Studies have also indicated that college students may be lacking in knowledge [9] of healthy food choices, especially when choosing from options available in the campus cafeteria [10]. This may be especially problematic, since

most students living in residence halls either opt to or are required to participate in meal plans provided by the university [3]. Campus dining halls are designed as all- you-can-eat buffets [3], and provide many options in order to satisfy all students [9]. Additionally, buffets are a cost effective way to provide the variety desired by student patrons [3]. Nutrient dense food choices are included in the buffet options; however, students tend to select and prefer foods higher in sugars and fats [4,9,11].

In addition to a large variety of foods, campus-dining halls also offer many types of dining plans. These include: "block meals" which limit students to a set number of meals per week (DCF 1-10); and unlimited plans that allow students to eat as many meals per week as they choose (DCF ≥ 11). As students may perceive the dining plan to be costly, they could attempt to get their "money's worth" when eating at the dining halls and consume more food than usual [9].

In studies where students were asked how the campus dining environment could be improved, suggestions included: decreasing the amount of unhealthy foods available, and promoting healthier options [9]. College students have also suggested including inexpensive produce around campus while simultaneously increasing the cost of unhealthy foods [12].

Living situations may also impact college students' eating behaviors, although the exact relationship is not clear [9]. Students who live off campus may choose to eat from convenience stores, skip meals, and purchase fast food items even though they could cook their own meals [3]. Typically convenience and fast foods are higher fat, and are not nutrient dense.

Surprisingly, given the risk for poor choices in college students, relatively few studies have examined nutrient intake in this population, especially regarding fat-soluble vitamins. Some studies have assessed overall dietary intake [3,4], other studies have assessed intake of individual nutrients, specifically fat-soluble vitamin (A, D, E and K) consumption among college students. In these studies, dietary intake is typically assessed using food frequency questionnaires [8,10,13,14] and multiple 24-hour food recalls [15,16]. However, no studies utilizing a three-day food record were identified. Additionally no studies were identified that compare fat-soluble vitamin intake in college students to the DRI for these vitamins.

Fat-soluble vitamins are essential to the body and involved in preventing chronic diseases including multiple sclerosis [17], osteoporosis [18], some cancers, and autoimmune diseases [2]. Adequate consumption of fat-soluble vitamins throughout a lifetime can decrease the likelihood of these chronic diseases and promote longevity [19]. Several studies have evaluated children and adult's dietary intake but college students are typically overlooked [20].

The purpose of this study was to investigate adequacy off at-soluble vitamin intake in college students compared to age and gender specific DRI's. Participation in campus dining plans was also assessed to determine any associations with fat-soluble vitamin intake in college students.

Methods

This research was approved by the Institutional Review Board for the Protection of Human Participants in Research at North Dakota State University. A cross-sectional design was utilized to assess 352 traditional college students (ages 18-30 years). Students were recruited from general education wellness courses in the spring of 2014. Researchers attended each class section to demonstrate accurate methods for measuring or estimating food portions. Researchers provided visuals for sizes of teaspoons, tablespoons, cups, and ounces through comparisons to common household items. After the demonstration, students were given an informed consent. The researchers explained the study and students were given the option to participate by signed the informed consent. Only students 18 years and older were included. Students were not offered any incentives for participation.

Data for the study was collected from a student completed 72-hour food record (three consecutive days, two weekdays and one weekend day). This record was completed as part of an assignment required for the course. Students were asked to choose days where food intake reflected their typical diet. Each student entered his or her age, height, weight, level of physical activity and daily food intake into Nutrition Calc (version 2010, McGraw-Hill Global Education Holding, LLC). Nutrition Calc has a database including over 27,000 foods from ESHA Food Processor (Oregon, Version 2014). ESHA developed and owns the rights to Nutrition Calc, claiming it is a reliable and valid tool for data analysis. Nutrition Calc calculates daily intake for a variety of macro -and micro - nutrients and also reports the DRI for these nutrients based age, body size and physical activity. The results are presented in a bar graph report. For the data used in this study; the bar graph report was used to determine students' actual caloric intake; fat intake (g); and intake of vitamin A (mcg), vitamin D (mcg), and vitamin E (mg).

Students also reported frequency of meals consumed at campus dining halls. Dining hall use was categorized into three groups representative of the different meal plans on campus: never eat on campus (indicative of no meal plan); eat on campus 1-10 times a week (indicative of a block meal plan providing 2 meals a day at the dining center); and eat on campus ≥ 11 times a week (indicative of an unlimited meal plan).

Descriptive statistics were used to identify age and gender characteristics of the group; assess recommended and mean calorie intake, mean fat intake in grams, percent of calories from fat, mean Vitamin A, D, and E intake; and frequency of dining hall use.

For the purposes of this study, meeting caloric needs was defined as consuming >95% of the calories recommended for age, gender, and body size.

Data analysis was conducted using Mini Tab 17 Statistical Software (State College, PA, 2011). Statistical significance for all tests was set at $p<0.05$.T-tests were used to test for differences in intake between gender groups. Chi-square tests were used to assess whether categories of dining hall usage were associated with fat-soluble vitamin intake. In this situation Fishers Exact Test was conducted using the statistical program, R (version 2.15.1, Vienna, Austria, 2012). Univariate regression was used to determine if number of meals in the dining hall was predictive of fat-soluble vitamin intake.

Results

Demographics and nutrient intake of the participants are shown in Table1. Of the 352 respondents, 212 were male (60.2%) and 140 were female (39.8%). Mean age of participants was 19.3 ± 1.6 years. Male students were slightly older than female students. The mean number of times per week students ate in the dining centers was 9 ± 8.7 with no difference in usage between male and female students.

dinner at White House [10]. The popularity of this typical Puglia's vegetable is probably due both to its aromatic taste and content of glucosinolates, well-known as important healthy compounds.

Characteristic	Total N = 352	Men N = 212 (60.3%)	Women N = 140 (39.7%)	t-Test	p-value
Age (years)	19.3 ± 1.6	19.5 ± 1.9	18.9 ± 1.0	10.3	0.001
Frequency of Dining at Residence Halls	9 ± 8.7	9.0 ± 8.1	9.0 ± 9.1	0.004	0.95
Recommended Calories	2829 ± 858	3316 ± 662	2092 ± 525	335.9	<0.001
Actual Calories	1996 ± 778	2306 ± 794	1526 ± 451	111.3	<0.001
Fat (g)[1]	70 ± 33.4	82.7 ± 35	50.4 ± 18.8	97.4	<0.001
% calories from Fat	31.3 ± 6.8	32.2 ± 7.1	29.8 ± 6.0	10.2	0.001
Vitamin A (mcg)[2]	550 ± 492	602 ± 539	471 ± 400	6.1	0.01
Vitamin D (mcg)	4.4 ± 4.5	5.1 ± 5.0	3.2 ± 3.2	15.2	<0.001
Vitamin E (mcg)	5.2 ± 6.2	5.3 ± 5.8	5.1 ± 6.8	0.1	0.76

[1]g = grams
[2]mcg = micrograms

Table 1: Demographic, Mean Weekly Dining Frequency, and Consumption of Calories and Fat-Soluble Vitamins among College Students.

The mean recommended calorie intake was 2829 ± 858. Male students had a higher recommended calorie intake than female students (3316 ± 662 vs. 2092 ± 525, $p<0.001$). The mean actual intake of calories was 1996 ± 778, approximately 1000 calories less than the recommended mean intake for both male and female. Male students had a mean intake of 2306 ± 794 calories compared to 1526 ± 451 calories consumed by female students ($p < 0.001$). Percent of calories from fat were within the Acceptable Macronutrient Distribution Range of 20-35%with male students consuming a larger percentage of calories from fat than female students ($p = 0.001$).

Fat-soluble vitamin intake varied between genders. Overall, 21.3% of the students met the DRI for vitamin A with mean intake of 550 ± 492 mcg. Vitamin A intake in male students was 602 ± 539 mcg (66.9% of the DRI) and was higher than that of female students who consumed 471 ± 400 mcg (67.3% of the DRI) ($p=0.01$). While actual intake in male students was higher than that of female students, female students met a higher percentage of the DRI for Vitamin A.

The mean consumption of Vitamin D among all participants was 4.4 ± 4.5 mcg per day (29.3% of the DRI). Only 3% of all students met the DRI for vitamin D. Male students consumed more vitamin D (5.1 ± 5.0 mcg per day) than female students (3.2 ± 3.2 mcg per day) ($p<0.001$).

Mean daily intake of Vitamin E was 5.2 ± 6.2 mcg (34.7% of the DRI) with 7% of all students meeting the DRI. Intakes between male and female students were relatively similar at 5.3 ± 5.8 mcg per day and 5.1 ± 6.8 mcg per day respectively (NS).

Table 2 shows frequency of dining hall usage by age and gender, and nutrient intake by frequency of dining hall usage. Approximately one-third, 34.7%, of the students (n=122) reported never eating on campus, while 22.4% (n=79) ate on campus up to 10 times a week, and 43% (n=151) ate on campus ≥ 11 times per week. Age differences were of significance with 85% of those who were 19 years or older indicating they did not eat in dining halls

($p<0.001$).

Calorie intake did not vary significantly between the various dining hall usage categories ($p=0.14$), and did not show a linear trend. Those who never ate at the dining halls consumed an average of 1963 ± 697 calories per day. Those who ate at the dining hall 1-10 times a week consumed the fewest calories (1879 ± 708) and, finally, those who ate at the dining hall ≥ 11 times a week had the highest calorie intake (2083 ± 866). As with calorie intake, no significant relationship was seen between dining hall usage categories and percent of calories from fat ($p= 0.19$). The mean percent of calories from fat for each category of dining hall frequency was 31.2% ± 7.0%, 32.4% ± 7.0%, and 30.6% ± 6.4% (0 times, 1-10 times and ≥11 times,)respectively. It is important to note that these percentages were within the Acceptable Macronutrient Distribution Ranges for percent of calories from fat.

Weekly Frequency of Dining in Residence Halls	0 (n=122)	1-10 (n=79)	≥ 11 (n=151)	p value
Gender				0.72
Male	77 (63.1%)	46 (58.2%)	89 (58.9%)	
Female	45 (36.9%)	33 (41.5%)	62 (41.1%)	
Age				<0.001
18	18 (14.8%)	28 (35.4%)	60 (39.7%)	
19+	104 (85.2%)	51 (64.6%)	91 (60.3%)	
Caloric Intake	1963 ± 697	1879 ± 708	2083 ± 866	0.14
% Calories from fat (20-35%)	31.2 ± 7.0	32.4 ± 7.0	30.6 ± 6.4	0.19
Vitamin A (F= 700 mcg, M = 900 mcg)	553 ± 430	479 ± 488	585 ± 538	0.30
Vitamin D (15 mcg)	4.8 ± 4.4	3.4 ± 4.1	4.5 ± 4.7	0.11
Vitamin E (15 mg)	6.5 ± 8.2	3.9 ± 7.8	4.9 ± 5.1	0.01

Table 2: Relationship of Dining in Residence Halls and Gender, Age, Caloric, Percent of Calories from Fat and Fat-Soluble Vitamins among College Students.

Mean intake for vitamin A and D was not significantly related to dining hall usage categories ($p=0.30$). However, mean intake of both vitamin A and D was lowest in students who ate at the dining hall 1-10 times per week. Additionally, mean intake of A and D was not sufficient to meet 70% of the DRI for these nutrients. Mean intake of vitamin E differed significantly between the categories of dining hall usage; however, again, this was not a linear trend. Those who did not eat at the dining hall had the highest mean intake at 6.5 ± 8.2 mg; whereas those who at the dining hall 1-10 times had the lowest intake at 3.4 ± 4.1 mg ($p = 0.01$). It should be noted, that none of these average intake levels meet the DRI of 12 mg/day.

Table 3 shows the percent of students meeting the intake recommendations for calorie, fat, and fat-soluble vitamins in comparison with DCF. In students with a DCF of 0, 83 students (61.0% male; 80% female) met the Acceptable Macronutrient Distribution Range (AMDR) for total calories from fat (20-35%); however, only 5 male (6.5%) and 1 female (2.2%) students met recommendations for calories. Furthermore, 23 students (37.3%) met the DRI for vitamin A; 3 male students (3.9%) met the DRI for vitamin D; and 9

In Table 3, of the students who obtained a DCF of 1-10, only 3 male (6.5%) and 2 female (6%) students met AMDR calorie recommendations. Also, 12 students met the DRI for vitamin A, 2 students met the DRI for vitamin D, and 3 students met the DRI for vitamin E. Nevertheless, a total of 22 male (47.8%) and 23 female (69.7%) students met the AMDR recommendations, 20-35%, calories from fat. O the students who obtained a DCF of ≥ 11, 13 students (8.6%) met AMRD calorie recommendations. An additional 37 students (25%) met the DRI for vitamin A, 6 students (4%) met the DRI for vitamin D, and 9 students (6%) met the DRI for vitamin E. Also, 58 male students (65.2%) and 48 female students (77.7%) met AMDR calorie from fat recommendations. Therefore, in the context of this study, students who obtained a DCF of ≥ 11 were more likely to meet the calorie from fat recommendations (20-35%).

Nutrient	0 times (n=122)		1-10 times (n=79)		≥11 times (151)	
	M (n=77)	F (n=45)	M (n=46)	F (n=33)	M (n=89)	F (n=62)
Caloric Intake	5 (6.5%)[1]	1 (2.2%)	3 (6.5%)	2 (6.0%)	5 (5.6%)	8 (12.9%)
% Calories from fat (20-35%)	47 (61.0%)	36 (80%)	22 (47.8%)	23 (69.7%)	58 (65.2%)	48 (77.4%)
Vitamin A (F= 700 mcg, M = 900 mcg)	15 (19.5%)	8 (17.8%)	5 (1.1%)	7 (21.2%)	21 (23.6%)	16 (25.8%)
Vitamin D (15 mcg)	3 (3.9%)	0 (0.0%)	1 (2.3%)	1 (3.0%)	6 (6.7%)	0 (0.0%)
Vitamin E (15 mg)	9 (11.7%)	4 (8.9%)	2 (4.3%)	1 (3.0%)	5 (5.6%)	4 (6.5%)

[1]Percent represents percent of gender meeting DRI

Table 3: Number and Percent of Participants Who Met Recommended Intake of Calories, Percent Calories from Fat and Fat Soluble Vitamins In Relation To Dining Categories.

Dining on campus is thought to have a positive effect on the intake of fat-soluble vitamins; however, this does not seem to be the case. As seen in Figure 1, 24% of those who ate on campus ≥ 11 times a week met the DRI for vitamin A. Of those who never ate on campus, 18% met DRI for vitamin A. However, those who ate on campus 1-10 times a week were least likely to meet the DRI with only 15% of those students achieving the recommended intake (p = 0.22).

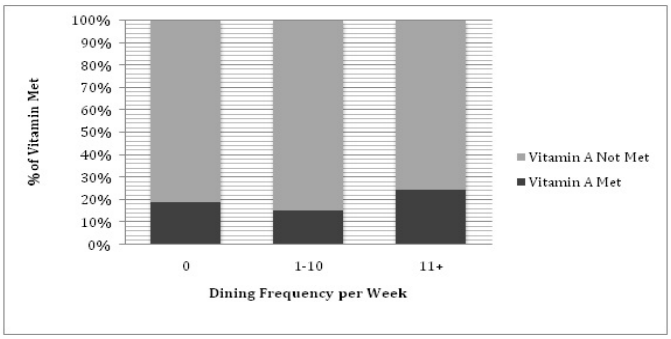

Figure 1: DRI of Vitamin A being Met According to Dining Frequency.

Univariate regression of number of meals consumed in the dining hall and fat-soluble vitamin intake showed no significant relationship for vitamin A or D (Figures 2 and 3). However, univariate regression for dining hall usage and vitamin E (Figure 4) showed a significant negative association (p=0.01).

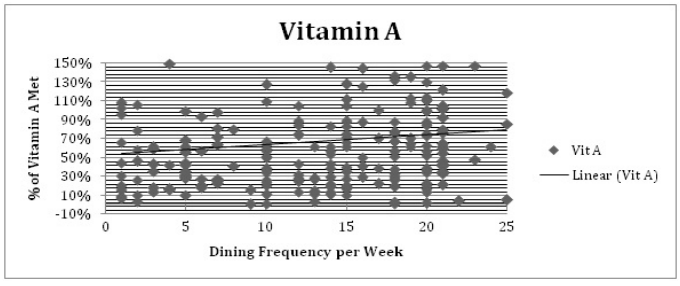

Figure 2: The Percentage of DRI for Vitamin A with Dining Frequency (p = 0.93).

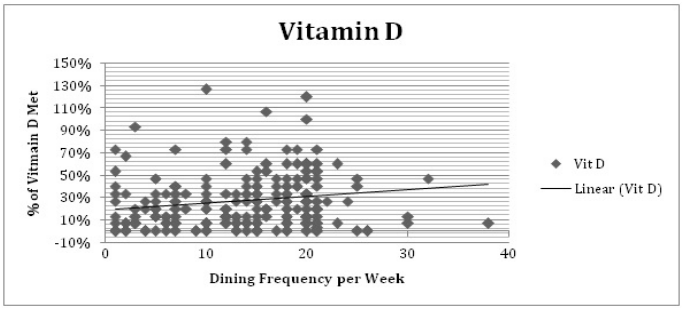

Figure 3: The Percentage of DRI for Vitamin D with Dining Frequency (p = 0.36).

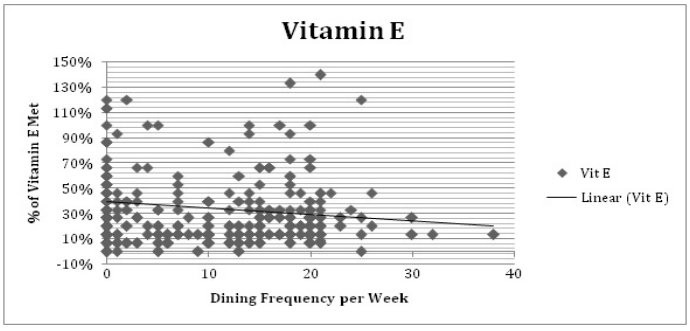

Figure 4: The Percentage of DRI for Vitamin E with Dining Frequency (p = 0.01).

Comment

Based on the results from this study, it appears that students, regardless of where they eat, are not meeting the recommendations for energy intake. Interestingly obesity rates in 2014 for 18-25 year olds in the U.S. ranged from 10.3% in Washington, D.C. to 23.9% in Arkansas [21]. In 2014, the rate of obesity in 18-25 year olds for the state in which this study was conducted was 18% [21]. The results of this study indicating that average student's calorie intake was approximately 1000 calories less than the RDA do not seem to support the 2014 obesity rates for 18-25 year olds in this state or in the U.S. This contradiction could have resulted from

several factors. Recall bias and misreporting of intake by the study participants could have been a factor. Additionally, students could have made errors in entering their actual intake into the analysis software. Another explanation could be that this particular group of 18-25 year olds does actually consume fewer calories than the 18-25 year old population at large. College students may not have the finances for excess food beyond what they are provided on a meal plan in the dining center. College students also may not spend much time on eating if they have to balance a full class schedule with working and other activities. Finally, it could also be that the DRI may overestimate the needs of this age group. A college student who has a full class schedule may spend a significant amount of time sitting in lecture halls and studying. These activities may not be as calorically expensive as the DRI's would estimate.

Students are making food choices containing a significant proportion of calories from fat; however, nutrient density appears to be lacking. A diet lacking in nutrient density could be a cause of inadequate fat-soluble vitamin intake in this study. Previous research suggests that living situation is associated with whether students meet the DRI for fat-soluble vitamins [3]; however the findings of this study are not congruent with that. The majority of students in all 3 dining categories were unable to meet the DRI for the 3 fat-soluble vitamins assessed.

Campus dining halls offer students a variety meal plans and dining options. Buffets are typically available and students gravitate to the higher fat foods [3,4,9,11]. This study supports research indicating that students choose higher fat foods as 100 students (28%) consumed more than 35% of calories from fat. Additionally, despite a low calorie intake, most students were still able to meet the AMDR for fat.

Living situations also have a strong influence on eating behavior. Research suggests that students who live off campus consume less nutrient dense foods than those who live on campus [9]. While this study did support this finding, it also showed that students eating on campus choose less nutrient dense foods. The majority of the students did not meet any of the DRIs for fat-soluble vitamins regardless of where they ate.

Vitamin D was least likely to be met among all fat-soluble vitamins examined. This could indicate a lack of food choices fortified with vitamin D (milk, orange juice, yogurt, etc.) This is alarming because students attending college are still maximizing bone density [22]. Ten male students met vitamin D intake, 3 of which never ate on campus, 1 ate on campus 1-10 times a week and 6 ate on campus ≥ 11 times a week. Unfortunately, female students were even less likely than male students to consume foods fortified with vitamin D. Female students may arguably be the subset of students who need vitamin D the most, as they tend to have a higher risk for osteoporosis [22]. Deficiency in vitamin D has also been linked to osteopenia, type 1 diabetes mellitus, insulin resistance, obesity, common cancers, cardiovascular disease, hypertension, multiple sclerosis, decreased immune function and an increase in infections [23].

Interestingly, vitamin E intake was higher in students who ate off campus. Of the students who never ate on campus, 20.6% met DRI for vitamin E; however only 7.3% of those dining on campus 1-10 times a week met the DRI, and 12.1% for those eating on campus ≥11 times week met the DRI. It is possible that those who ate off campus may have consumed nuts and seeds more frequently, as those foods travel easily. Moreover, off-campus eaters may have been cooking at home and been more aware of how their food was prepared. Therefore, they may have been able to report all of components of their meals, including the cooking oils. Those who ate on campus may have been unaware of the oils used to prepare their foods; therefore, they did not record oils in the nutrient analysis software.

Vitamin A was the most likely DRI to be met, especially in those students who ate on campus ≥11 times a week. Vitamin A and its precursors are found in whole foods, as opposed to oils that may be used in the preparation of foods. Students may be more aware of their whole food consumption than their oil consumption. Therefore, they would be more likely to enter those whole foods into a nutrient analysis program. A higher percentage of male students who never ate on campus and males who ate on- campus ≥11 times per week met the DRI for vitamin A. However, both males and females who ate at the dining hall 1-10 times a week were least likely to meet this DRI.

In general, those who ate on campus 1-10 times a week consumed fewer fat-soluble vitamins than those who ate off campus or those who ate on campus ≥11 times a week. If dining on campus improves a student's intake, a linear relationship between fat-soluble vitamin intake and number of times eating in campus dining halls would be expected. A possible explanation for the lack of linear relationship seen in this study could be that during the times a student is not eating on campus, they may not be eating or choosing very nutrient poor foods. We assume that a student who eats on campus 1-10 times a week is consuming up to two meals per day on campus between Monday and Friday. These students are eating elsewhere for their remaining meals. It is unknown to the researchers where the students with limited meal plans eat when they are not eating in the dining halls. It may be that students with limited meal plans are eating less nutrient dense convenience foods or not eating at all when they are not dining on campus.

Limitations

A limitation of this study is that it did not examine nutrition knowledge, attitudes, resources, skills in meal preparation, or self-

efficacy for meal planning. Therefore, we cannot be certain of why students chose the foods they chose. This study only presents a3-day "snap-shot" of what students choose to eat. Another limitation of this study, is that the actual foods consumed were not reviewed, only the nutrient output from Nutrition Calc. It is possible that students may have incorrectly entered food choices, become disinterested in completing the project, or may not have been able to find the food item consumed in the database. This could impact the nutrient output of the software.

Conclusion

Regardless of living situation, students on campus may not be meeting nutrient recommendations for fat-soluble vitamins or calories. This is especially concerning for Vitamin D. Future research should closely examine college students' intake patterns for vitamin D and reasons they choose or do not choose foods that provide vitamin D. With more detailed research, interventions could be developed to promote and increase Vitamin D intake in this population. Future research should also include a more detailed assessment of foods available at and consumed in campus dining centers. This research should include an analysis of the foods and cooking methods used in the dining halls.

Additionally, more research is needed on college students' foods choice, attitudes and beliefs about food in order to understand their eating patterns. It would be beneficial to assess students' culinary skills, which could be a predictor of their confidence in preparing foods if they are cooking for themselves. With the knowledge of attitudes, beliefs, eating patterns, and culinary skills, education programs that promote healthy eating could better target students' needs.

References

1. Dietary Guidelines for Americans (2015) Washington DC.
2. Litonjua AA (2012) Fat-soluble vitamins and atopic disease: what is the evidence? Proc Nutr Soc 71: 67-74.
3. Freedman MR (2010) Gender, residence and ethnicity affect freshman BMI and dietary habits. Am J Health Behav 34: 513-524.
4. Ouellette CD, Yang M, Wang Y, Yu C, Fernandez ML, et al. (2012) Assessment of nutrient adequacy with supplement use in a sample of healthy college students. J Am Coll Nutr 31: 301-310.
5. Deliens T, Clarys P, De Bourdeaudhuij I, Deforche B (2013) Weight, socio-demographics, and health behaviour related correlates of academic performance in first year university students. Nutr J 12: 162.
6. Larson NI, Neumark-Sztainer DR, Story MT, Wall MM, Harnack LJ, et al. (2008) Fast food intake: longitudinal trends during the transition to young adulthood and correlates of intake. J Adolesc Health 43: 79-86.
7. Minton E (2015) Healthy eating: Improving your convenience foods. University of Florida, USA.
8. Musingo MN and Wang L (2009) Analysis of eating habits according to socio-demographic characteristics of college students. Pakistan J Nutr 8: 1575-1580.
9. Lacaille LJ, Dauner KN, Krambeer RJ, Pedersen J (2011) Psychosocial and environmental determinants of eating behaviors, physical activity, and weight change among college students: a qualitative analysis. J Am Coll Health 59: 531-538.
10. Hendricks KM, Herbold N, Fung T (2004) Diet and other lifestyle behaviors in young college women. Nutr Res 24: 981-991.
11. El Ansari W, Stock C, Mikolajczyk RT (2012) Relationships between food consumption and living arrangements among university students in four European countries - a cross-sectional study. Nutr J 11: 28.
12. Gruber KJ (2008) Social support for exercise and dietary habits among college students. Adolesc 43: 557-575.
13. McLean-Meyinssea PE, Harrisb EG, Taylorc SS, Gagerd JV (2013) Examining college students' daily consumption of fresh fruits and vegetables. Journal of Food Distribution Research 44: 10.
14. Perera T and Madhujith T (2012) The pattern of consumption of fruits and vegetables by undergraduate students: a case study. Trop Agricl Res 23: 261-271.
15. Hampl JS and Betts NM (1995) Comparisons of dietary intake and sources of fat in low- and high-fat diets of 18- to 24-year-olds. J Am Diet Assoc 95: 893-897.
16. Mitmesser SH, Giraud DW, Driskell JA (2000) Dietary and plasma levels of carotenoids, vitamin E, and vitamin C in a group of young and middle-aged nonsupplemented women and men. Nutr Res 20: 1537-1546.
17. Torkildsen Ø, Løken-Amsrud KI, Wergeland S, Myhr KM, Holmøy T (2013) Fat-soluble vitamins as disease modulators in multiple sclerosis. Acta Neurol Scand Suppl 196: 16-23.
18. Ahmadieh H and Arabi A (2011) Vitamins and bone health: beyond calcium and vitamin D. Nutr Rev 69: 584-598.
19. Winkleby MA and Cubbin C (2004) Changing patterns in health behaviors and risk factors related to chronic diseases, 1990-2000. Am J Health Promot 19: 19-27.
20. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA (2008) Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. Obesity 16: 2205-2211.
21. Health TTFAs, Foundation RWJ. The State of Obesity: Obesity rates by age group. USA.
22. Health NI (2015) Osteoporosis: Peak bone mass in women. NIH Osteoporosis and Related Bone Diseases National Resources Center 1-2.
23. Holick MF (2006) High prevalence of vitamin D inadequacy and implications for health. Mayo Clin Proc 81: 353-373.