

Influences of Physical Environments on University Student Eating Behaviors

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Abstract

Faced with rising tuition costs and limited financial means, university students experience a range of physical environments that can have an impact on their eating behaviors and health. Data was gathered from 188 students from two Canadian east coast universities to determine relationships between their day to day living and eating arrangements and self-reported three day food frequency intakes. Hypotheses testing with bivariate analyses were conducted. Students had a range of living arrangements, only 15% ate half or more of their meals in the university cafeteria and few met the minimum food guide recommendations for vegetables/fruits and grains, in particular. Statistically significant relationships were found between the living and eating arrangements and intakes of grains, meat/alternates and some foods to limit. University healthy eating promotion strategies for students need to be multifaceted and consider the variety of aspects of their physical environments as well as the other determinates of health.

Keywords: Eating behaviors; university students; environmental influences

1. Introduction

With the growing body of evidence that many nutrition related short term and chronic health problems are preventable, there is an important role for socially responsible governments and public institutions to play in promoting and supporting healthy eating behaviors at all stages of life. Faced with rising tuition costs, limited financial means and inexperience, university students employ a range of approaches for their accommodation and nutrition. Whether they live in residence, or on their own or with friends or family; and whether they eat most meals at home with parents, from university cafeterias, prepare their own meals or with others, eat from fast food outlets or skip meals can have important impacts on their eating behaviors, health and academic success.

This study explores the impacts of the physical environments or where university students live and where they eat most of their meals on their self-reported intake of food groups and foods to limit. It is anticipated that the findings will assist socially responsible governments and universities in identifying effective environmental strategies for the promotion and support of healthy eating behaviors among students.

1.1 Eating behaviors and health

There is a solid foundation of evidence supporting the role of good nutrition in health at all stages of life. Not only do healthy eating behaviors support optimal growth and development throughout childhood, but they can reduce the risk of developing chronic conditions associated with obesity such as diabetes, cardiovascular disease, some

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cancers and some musculoskeletal diseases (World Health Organization [WHO], 2015a; Centers for Disease Control and Prevention [CDC], 2015). Ensuring that nutrition requirements are met through healthy eating behaviors is also associated with improved cognitive function (such as memory), concentration and mood (Burrows, Goldman, Pusey & Lim, 2016; CDC, 2014). Therefore supporting and promoting healthy eating behaviors among university students will not only contribute to their lifelong health but also to their academic achievement.

Obesity is now a worldwide health problem (WHO, 2015b) and the incidence has more than doubled in the last 25 years with recent estimates that 39% of adults were overweight and 13% obese (WHO, 2015a). In a multinational study, it was determined that increases in supply of food energy was more than enough to explain the increases in population body weight from 1971 to 2010 (Vandevijvere, Chow, Hall, Umali & Swinburn, 2015). For example, the daily per person food energy increased by 559 calories in Canada and by 768 in the USA and much of the calorie increase was in processed, palatable, promoted and affordable (PPPA) foods (Vandevijvere et al, 2015). While there are many other contributors to overweight and obesity including sedentary lifestyles and factors still being investigated such as infections, pollutants and gut bacteria, Vandevijvere et al (2015) recommended that government agencies address the food supply in order to reduce obesity and associated health problems.

Determinants of healthy eating provide a framework for understanding the influences on eating behaviors (Raine, 2005; LaCaille, Sauner, Krambeer & Pedersen, 2011; Brug, Kremers, van Lenthe, Ball & Crawford, 2008). In this framework, individual determinants (knowledge, perceptions, physiological and psychological) interact with environmental determinants (physical, economic, social-cultural and political). Brug et al (2008), concluded that there is a lack of evidence about the environmental determinants and their role in developing effective healthy eating policy and promotion strategies. Not to undermine the value of the economic, social-cultural and political determinants, there is utility in examining the role of the physical environment, in particular its 'obesogenic' features (Brug et al, 2008) and in light of the Vandevijvere et al (2015) report. 'Obesogenic' environment refers to having an excess availability and access to high calorie foods that encourage over consumption (Brug, van Lenthe & Kremers, 2008) or PPPA foods (Vandevijvere et al, 2015).

However physical environment interventions alone may not be enough to change eating behaviors. A study to determine the effectiveness of school nutrition policies that banned soda and junk food on the eating behaviors of senior high school students in Los Angeles, found significantly greater behavior changes at school than at home (Vecchiarelli, Takayanagi & Neumann, 2006). The authors went on to recommend that policies need to be coordinated with nutrition education, foodservice and involvement by those who purchase and prepare meals, at school and in homes. Further and based on a systematic review of recent research, Brug et al (2008) noted that understanding perceptions about the environments is important; and that healthy eating promotion strategies should focus on making consumers more aware of opportunities in their environments such as availability of nutritious foods.

1.2 University students

In 2011/12 there were almost two million students attending universities in Canada; almost 2% higher than the previous year (Statistics Canada, 2013b). Post-secondary education participation rates have been high for many years as 64% of Canadians 25 to 64 years of age hold degrees (Statistics Canada, 2013b). In the USA, university enrollment has also increased by 24% between 2002 and 2012; from 16.6 to 20.6 million students (US Department of Education, 2015).

The costs of university education continue to rise and this contributes to the challenge for university students to follow healthy eating behaviors. In Canada, tuitions have been increasing at a rate of over 3.0% a year over the past few years (Statistics Canada, 2015). Average tuition in 2015/16 was \$6,191/year ranging from \$2,660 in Newfoundland/Labrador to \$6,817 in Nova Scotia to \$7,868 in Ontario (Statistics Canada, 2015). However, tuition is only a part of the cost of university education. For 2012/13 it was estimated that in the USA, public university undergraduate tuition, accommodation and meals cost \$15,022/year, an increase of 39% from 2002/3 (US Department of Education, 2015).

There have been a number of studies that have examined the impacts of physical environments on university student eating behaviors and how that has impacted their health. While the results are sometimes contradictory, they all highlight the need for healthy eating promotions that address the physical environments as well as the consumer

behaviors. In a study of 503 undergraduates at a western USA university, it was found that while few met each of the food group recommendations, significantly more students participating in the campus meal plan met the recommendations for fruits and meats (Brown, Dresen & Eggett, 2005).

Grain consumption was higher for those without a meal plan and, as noted by the authors, likely due to eating easy to prepare items such as cereals, pastas and sandwiches. Gender seemed to have played a role in vegetable consumption as significantly more males on meal plans ate more vegetables than females; but, again noted by the authors, this may have been due to consumption of more French fries (Brown et al, 2005).

Findings from a study of 585 mid-western university students noted that those living off campus tended to have higher body mass indexes and practice less healthy lifestyle behaviors than those living on campus or with parents (Brunt & Rhee, 2008). In total, thirty-four percent were overweight or obese and 4% underweight; with males living off campus three times more likely to be overweight or obese compared to those living on campus or with parents. Those living on campus ate a greater variety of vegetables, fruits and milk products. The reasons for the difference were not explored but the authors suggested that it could be due to a range of environmental determinants including availability and costs of food, and the skills and time to prepare meals (Brunt & Rhee, 2008).

Based on data from a large population study that tracked young people (n=1,687, 18 to 25 year olds) from high school to university from 1998/99 to 2003/4, results indicated that those living and eating on campus ate more regular meals, had better nutrition intakes and had more nutritious foods available to them than those living on their own or with friends or family (Laska, Larson, Neumark-Sztainer & Story, 2009). However no matter the living status, few met the food guide recommendations for fruits, vegetables and whole grains (Laska et al, 2009). However there is some evidence that students living on campus may face other threats to their healthy eating behaviors. An interesting study reported that students living in residences tended to have a range of high calorie, fat, sugar and salt snacks in their rooms and that their parents provided many of these items (Nelson & Story, 2009).

In contrast, however, a western Canadian university study reported that students living at home with their parents had better eating behaviors than those living on campus or on their own or with friends (Jackson, Berry & Kennedy, 2009). The authors also reported that, for commuter students, purchasing meals on campus was correlated with fast food consumption and that higher spending on food was also associated with more fast food consumption (Jackson et al, 2009).

These studies explored either the impacts of living arrangements or participation in campus meal plans on eating behaviors of university students. However, as many students now employ a variety of living and eating arrangements, there is value to explore the impacts of where they choose to live and where they choose eat on both healthy and unhealthy eating behaviors.

2. Purpose and Hypotheses

2.1 Purpose

The purpose of this study was to determine relationships between physical environment determinants, in particular where students lived and where most of their meals were consumed, on their self-reported average three-day food frequency intakes of food groups, food group directional guides and foods to limit. The following hypotheses were created based on the literature for examination in this study.

2.2 Hypotheses

Where Students Live and Eat Most Meals

H1: University students who live with their parents will consume fewer meals in the campus cafeteria.

Where Students Live Related to Food Guide Recommendations

H2a: University students who live with their parents will meet the recommendations for food group servings and directional statements (green and orange/red vegetables, and whole grains) from the national food guide.

H2b: University students who live with their parents will consume fewer servings of foods to limit including the PPPA foods, French fries, processed meats and pizza.

Where Students Eat Related to Food Guide Recommendations

H3a: University students who consume more meals from the university cafeteria will not meet the recommendations for food group servings and directional statements (green and orange/red vegetables, and whole grains) from the national food guide.

H3b: University students who consume more meals from the campus cafeteria will eat more servings of foods to limit including the PPPA foods, French fries, processed meats and pizza.

3. Methodology

3.1 Participants

As described previously (Blotnicky, Mann & Joy, 2015), this study was approved by the university research ethics board. An online survey link was distributed to professors who were asked to share the link with their students. Classes were randomly chosen from two urban east coast Canadian universities in 2012. Participating students had the option to enter a draw for an amazon.ca gift card.

3.2 Variables

The variables for the hypotheses testing were drawn from the responses to selected questions from the survey. The “where students lived” variable was based on responses to the following options: at home with parents, in an apartment or home with others or self, or in a university residence. Students were asked to identify the percentages (ranging from 0 to 100%) for sources of meals and snacks (university cafeteria, fast food or restaurant, prepare meals by self or with others, vending machines or snacks). The variable for “eating 50% of meals from the university cafeteria” was determined from responses to this question.

The three-day food frequency questions were based on the food groups, serving sizes and directional statements of the Canada Food Guide (Health Canada, 2007). For example, “In the past three days approximately how many times did you eat a serving of green vegetables?”; (1 serving size=½ cup; image of size of a fist). Prior to analysis, the three-day food servings were converted into daily food servings. Dummy coding (1 or 0) was used to indicate whether or not the recommended number of servings had been eaten for each of the four food groups. The cut-off for meeting recommended number of servings was five per day for each of vegetables/fruits and grain groups and two servings each for milk/milk alternates and meat/meat alternates groups (Garriguet, 2007; Statistics Canada, 2013a; WHO, 2015c).

Cut-offs for directional statements included one serving daily of green vegetables and red/ orange vegetables, as well as eating at least half of one’s daily grain servings from whole grain sources (Health Canada, 2007). Foods to limit, as described by the national food guide (Health Canada, 2007), included servings of French fries, processed meats, pizza, ice cream, cakes, pies, muffins, spreads, chips and sodas. For this analysis, specific PPPA foods from the foods to limit group included servings of French fries, processed meats and pizza.

3.3 Analyses

The hypotheses were tested using bivariate analyses including: Chi-square, independent samples t-test, and univariate ANOVA. Where necessary, the Brown-Forsyth exact test was substituted for ANOVA due to violations for homogeneity of variance.

4. Results and Discussion

4.1 Participants

As previously reported, there were 188 student respondents: 79% were female and the average age was 22 years \pm 4.7 (Blotnicky et al, 2015). Most students lived in apartments off-campus (50%), followed by living with parents (29%) and living on-campus (21%). Only 15% ate more than half of their meals in the cafeteria. Table 1 summarizes the student demographic profile.

Table 1: Student Demographic Profile (n=188)

Measure	Number (%)
Single	148(79%)
Married/Living Separated/Divorced/Widowed	35(19%) 4 (2%)
Arts	103(55%)
Business Administration	16(8%)
Science	37(20%)
Professional Studies	18 (10%)
Nutrition	2 (1%)
Education	11 (6%)
First year of study	61 (33%)
Second year	40 (21%)
Third year	31 (17%)
Fourth year	29 (16%)
Five years or more	26 (14%)
Living with parents	54(29%)
Living off-campus in apartment	91 (50%)
Living on-campus	38 (21%)
Ate less than 50% of meals in university cafeteria	160 (86%)
Ate 50% or more meals in university cafeteria	27 (15%)

4.2 Food guide recommendations

As summarized in Table 2, students consumed average daily servings of 3.7 for vegetables/fruits, 2.4 for grains, 2.1 for milk/milk alternates and 1.5 for meat/meat alternates. This is lower for three of the food groups compared to the most recent Canadian data that reported average vegetables/fruits servings for 19 to 30 year olds ranging from 4.67-5.36; grains 5.19-7.98, milk/milk alternates 1.64-1.95 and meat/meat alternates 2-3.5 (Garriguet, 2007). By contrast, consumption of foods to limit, ranged from none to 11 servings daily, with an average of 3.7 servings.

Table 2: Food Group Servings and Food Guide Recommendations

Food Group Daily Servings (recommended servings/day)	Number Respondents; Average (Std. Dev)	Min (Max)	Meets CFG Recommendations n (%)
Vegetables/Fruits (5)	140; 3.7 (2.0)	0 (16)	32 (26%)
Grains (5)	154; 2.4 (1.4)	0 (10)	8 (5%)
Milk/Milk Alternates (2)	154; 2.1 (1.1)	0 (6.7)	83 (73%)
Meat/Meat Alternates (2)	157; 1.5 (1.1)	0 (6.3)	38 (35%)
GreenVegetables(1)	154; (0.88) .70	0 (3.3)	
Red/Orange Vegetables (1)	154; 0.65 (.05)	0 (2.7)	
Whole Grain as Total Grains (50%)	154; 26.7% (1.9%)	0% (100%)	
Foods to Limit Overall	154; 3.7 (2.1)	0 (11)	
French Fries	158; .19 (.35)	0 (1.7)	
Processed Meats	155; .26 (.43)	0 (2.7)	
Pizza	158; .26 (.42)	0 (1.7)	

Also as shown in Table 2, very few students actually met the recommendations for food guide minimum numbers of servings per food group. The poorest result was for grains with only 5% eating five or more servings per day. It is possible that students may limit intake of these foods due to concern about excess calories or assume that some foods to limit such as muffins or granola bars are appropriate grain servings. Only 26% met the recommended number of servings for vegetables/fruits, 73% for milk/milk alternates and 35% for meat/meat alternates. These results are similar to the most recent national data for the milk/milk alternates group but lower for all other food groups.

For example, 39% of Canadians ate five or more servings of vegetables/fruits per day (Garriguet, 2007; Statistics Canada, 2014). Alarming, it has been reported that only 5.4% of students responding to the American College Health Association (ACHA) 2015 survey ate five or more servings of vegetables/fruits per day which may be due, in part, to under reporting given that students may not be aware of the serving sizes (ACHA, 2015).

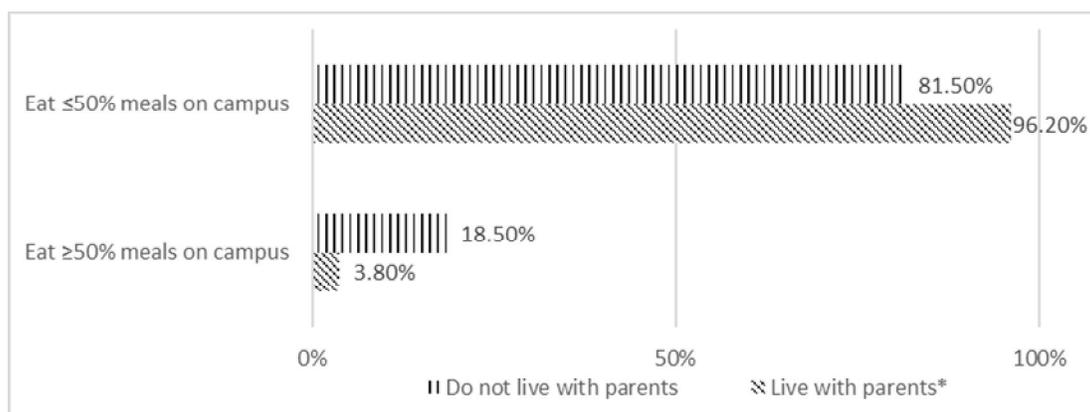
Recommendations or directional statements for daily servings of green vegetables, red/orange vegetables and whole grains were not met by the students in the sample (Table 2). The number of daily servings for green vegetables ranged from none to 3.3 with an average of .88 of a serving, less than the minimum recommendation of one serving daily. Similarly, the recommended one daily serving requirement for red/orange vegetables was not met as students consumed an average of .65 servings daily. While not specific about the categories of vegetables consumed, most youth do not meet the recommended numbers of servings for vegetables (CDC, 2015; Statistics Canada, 2014) which are sources of important nutrients. The national food guide recommends that at least half of all servings of grains consist of whole grains. However students in this study consumed an average daily intake of only 27% servings of grains as whole grains. This is even more of a concern, as noted above, few students met the overall recommendation for grains. Similarly it has been reported that most college students and youth do not eat the minimum amount of whole grains (Laska et al, 2009; CDC, 2015).

Students should minimize their consumption of foods that are high calorie, high fat and high sodium. This research focused on the foods to limit group overall and three foods that are readily available and affordable on campus and in the community. As summarized in Table 2, the average daily servings of foods to limit was 3.7, and of this French fries ranged from none to 1.7 daily with an average consumption of .19 of a serving. Processed meats and pizza were consumed more frequently with an average consumption of .26 servings daily each. While it is evident that foods to limit are a large part of the diets of students, it is encouraging that on average French fries, processed meats and pizza are less so. However, these foods contribute to an 'obesogenic' environment (Brug et al, 2008) that may be a negative influence for those who are at greater risk of overweight or obesity (Boyle & LaRose, 2008).

4.3 Where students live and eat most meals

As illustrated in Figure 1, a Chi-square analysis revealed a statistically significant association between whether or not students lived with their parents and the proportion of meals eaten in the university cafeteria. Therefore, the null hypothesis was rejected. However, the results were not substantive because neither group of students ate 50% or more of their meals on campus. There may be a variety of reasons for this including perceptions about the cafeteria, foods available and costs.

Figure 1: Where Living and Eating in the University Cafeteria (n=183)



* Living with parents students significantly less likely to eat $\geq 50\%$ meals on campus ($X^2=6.66$, $df=1$, $p=.01$)

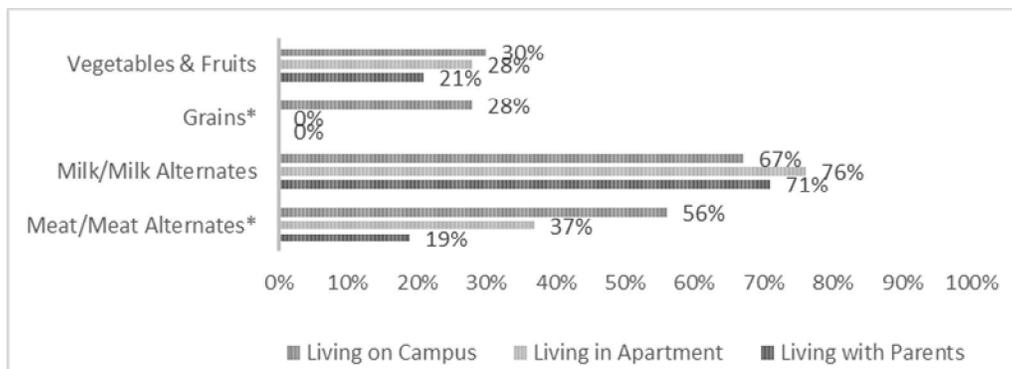
Students were also asked to report their satisfaction with the university cafeteria based on a number of factors. While the majority were satisfied with physical environment factors such as location (81%, $n=138$) and hours of operation (64%, $n=138$), less than half reported satisfaction with perceptions about the food and its economic value such as food being nutritious (46%, $n=139$) and good value (34%, $n=139$).

This may be important for university food service providers to address as having positive perceptions about the physical environment and foods available were found to be more effective in following healthy eating behaviors for those students who were overweight or obese as compared to normal weight students who were more affected by their own nutrition self-efficacy (Boyle & LaRose, 2008).

4.4 Where students live related to food guide recommendations

As illustrated in Figure 2, 70% to 79% of students in all three living arrangements reported that they did not consume the recommended number of servings for vegetables/fruits. As summarized in Table 3, the average number of daily servings consumed from this food group ranged from 2.27 for those living with parents to 4.01 for those living on campus. In contrast, 67% to 71% of students in all living arrangements met the recommended servings for the milk/milk alternates food group with the average number of servings at the recommended of two per day. As the differences were not statistically significant for either food group, the null hypotheses could not be rejected.

Figure 2: Where Students Live and Meeting Food Guide Recommendations



* Significant differences:

Living on campus students significantly more likely to meet grain recommendations than other living arrangements ($X^2=30.637$, $df=2$, $p=.000$) Living on campus students significantly more likely to meet meat/meat alternate recommendations than other living arrangements ($X^2=8.611$, $df=2$, $p=.013$)

However, there were statistically significant differences between living arrangements and whether or not students met the recommended daily servings for meat/meat alternates and grains; therefore the null hypotheses for these food groups were rejected. There was a wide range for the meat/meat alternates group with only 19% of students living with parents to 56% of those living on campus meeting the recommendations. The average number of daily servings ranged from 1.27 to 1.93. While students living with their parents or in off-campus apartments did not meet the food guide recommendations for grain servings with averages of 2.08 and 2.19 servings per day, 24% of those living on campus did, with an average of 3.29 servings per day. This is in contrast to the findings of Brown et al (2005) who found that grain consumption was higher for those living off campus (without a meal plan).

As shown in Table 3, students who lived with their parents consumed statistically significantly fewer servings of red/orange vegetables than did students who resided on campus or off-campus in an apartment. The recommended number of daily servings for red/orange vegetables was one, but students who lived with their parents consumed an average of .47 servings daily, compared to .72 to .74 for those with the other living arrangements. While those students living with their parents also consumed fewer servings of green vegetables, the results were not statistically significant. Nor was any significant relationship found for consumption of whole grains by where the students lived.

Table 3: Where Students Live and Eat related to Food Guide Recommendations and Foods to Limit

Number/Mean (Std. Deviation)	Live with Parents	Live in Apartment	Live on Campus	Eat <50% Meals in Campus Cafeteria	Eat ≥50% Meals in Campus Cafeteria
Vegetables/Fruits	40/3.27 (1.76)	70/3.79 (1.70)	26/4.01 (2.96)	126/3.48 (1.73)	13/5.2 (3.32)
Grains	48/2.08 (1.17)	74/2.19 (1.15)	29/3.29 (1.8)*	138/2.2 (1.22)	16/3.64 (1.77)*
Milk/Milk alternates	48/2.07 (1.16)	76/2.12 (.99)	26/1.99 (1.37)	140/2.10 (1.05)	14/1.73 (1.54)
Meat/Meat alternates	48/1.27 (.92)	77/1.55 (1.14)	29/1.93 (1.10)*	141/1.44 (1.05)	16/2.20 (1.09)*
Green Vegetables	48/.76 (.67)	74/.93 (.76)	29/.90 (.71)	135/.84 (.72)	19/1.1 (.58)
Red/Orange Vegetables	48/.47 (.48) *	74/.72 (.62)	29/.74 (.53)	135/.61 (.57)	19/.92 (.50)
Grains as % whole grains	47/22% (26%)	73/30% (23%)	29/23% (19%)	134/28% (25%)	19/20% (15%)
Foods to Limit Overall	47/3.50 (1.67)	76/3.78 (1.92)	27/3.80 (3.10)	137/3.60 (1.90)	17/4.40(3.20)
French Fries	48/.15 (.26)	77/.13 (.27)	29/.45 (.54)	138/.15 (.29)	20/.47 (.56)*
Processed Meats	48/.21 (.39)	77/.24 (.36)	27/.46 (.62)	138/.26 (.44)	17/.30 (.37)
Pizza	48/.15 (.25)	77/.28 (.41)	29/.42 (.61)*	138/.24 (.38)	20/.39 (.62)

(n=150 for living arrangements and n=154 for on-campus food consumption)

* Significant differences:

Living on campus students' consumption of grains significantly higher than other living arrangements (BF=7.365, df=2/66.1, p=.001)

Living with parents students' consumption of meat/alternates significantly lower than other living arrangements (F=3.358, df=2/150, p=.037)

Living with parents students' consumption of red/orange vegetables significantly lower than other living arrangements (F=3.32, df=2/147, p=.04)

Living on-campus students' consumption of pizza significantly higher than other living arrangements (BF=7.081, df=2/49.8, p=.002)

Eat ≥50% of meals on campus French fries consumption significantly higher than eating <50% of meals on campus (t=-2.487, df=20.1, p=.021)

Eat ≥50% of meals on campus grain servings consumption significantly higher than eating <50% of meals on campus (t=-.43, df=152, p=.000)

Eat ≥50% of meals on campus meat servings consumption significantly higher than eating <50% of meals on campus (t=-2.754, df=155, p=.007)

4.5 Where students eat related to food guide recommendations

Also as summarized in Table 3, the average number of daily servings of vegetables/fruits ranged from 3.4 for those who ate less than half their meals in the campus cafeteria to 5.2 who ate half or more. While the results were just marginally insignificant, indicating fair variability in each group, the on campus group, on average, met the recommended number of servings for vegetables/fruits. In contrast, only those who ate less than half of their meals on campus, on average, met the recommendations for the milk/alternates food group. The results were not statistically significant, therefore the null hypothesis could not be rejected.

Students who ate most of their meals in the campus cafeteria as compared to those who didn't, consumed statistically significantly more average number of daily servings for meat/alternates and grains. Those eating most meals on campus consumed an average of 2.2 servings of meat/alternates and 3.6 servings of grains as compared to 1.44 meat/alternates and 2.2 grains for those eating less than half of their meals on campus. Those who ate most meals on campus, on average, met the recommendation for the meat/alternates food group but neither group met the recommendation of five daily servings for grains. Further, no significant relationships were found between where students ate most of their meals and the food guide directional statements for green, red/orange vegetables and whole grains. As noted in the University Students section of this paper, other studies also determined that students who participated in a meal plan or lived on campus as compared to living off campus or with parents, had better eating behaviors (Brown et al, 2009; Brunt & Rhee, 2008; Laska et al, 2009).

However, this should be interpreted with caution as, has been previously noted, few students, no matter where they lived, ate more than 50% of their meals from the campus cafeteria.

4.6 Where students live and eat related to consumption of foods to limit

As summarized in Tables 2 and 3, students consumed an average of 3.7 servings of foods to limit daily and this was relatively consistent across all of the living arrangements. A one-way ANOVA revealed that there were no statistically significant associations between living arrangements and the number of servings consumed from the foods to limit ($BF=.234$, $df=2/53.2$, $p=ns$); therefore, the null hypothesis was not rejected. By contrast Jackson et al (2009) reported that students living off-campus ate more from the foods to limit. While those who ate more than half of their meals in the university cafeteria consumed more servings of food to limit than those who ate less than half of their meals there, the difference was not significant ($t=-.931$, $df=16.9$, $p=ns$). Therefore, the null hypothesis was not rejected.

However, when a narrower selection of foods to limit, the PPPA, was tested, significant relationships were found. As summarized in Table 3, students who lived on-campus consumed statistically significantly more pizza than students who lived with their parents with average number of daily servings ranging from .15 to .42. The results of an independent sample t-test showed that there were statistically significant differences in the consumption of French fries by those who ate 50% or more of their meals in the cafeteria, but no significant differences for processed meats or pizza. Those who ate more meals on campus consumed an average of .39 servings of French fries daily compared to .24 servings daily for those who ate less than half of their meals on campus. Of interest, Brown et al (2005) suggested that the higher vegetable consumption by those on meal plans was likely due to consumption of French fries which they categorized as a vegetable rather than a 'food to limit'.

4.7 Limitations

As the sample for this research was from two east coast Canadian universities, skewed to first and second year students and mostly female, a limitation is that the findings may not be representative of all university students. The number of students living on campus, and eating most of their meals on campus, was limited. This resulted in small cell sizes for some t-test and ANOVA, which could have impacted the analysis. The use of the Brown-Forsyth exact test as an alternative to ANOVA may have overcome some limitations due to sparse cells and violations of homogeneity of variance, but it is possible that more of the results would have been statistically significant if a larger sample was available.

The food frequency questions may not have been comprehensive to include all possible foods within the food groups; therefore the determinations for numbers of servings per food group may not reflect actual intakes. However, the findings are comparable to other reports and it would not have been feasible to have gathered more detailed food records. Similarly the self-reporting may be a limitation but this needs to be balanced with maximizing response rates. The use of descriptions and images for the serving sizes is believed to have enhanced accuracy. Several variables have been used to capture healthy eating. These constructs include the number of daily servings and adherence to Canada's Food Guide (Health Canada, 2007), measures related to variety of vegetables and grains consumed, and consumption of specific PPPA foods. There may be other measures that would be helpful indicators of healthy eating that were not included in this analysis. Therefore, results of this study should be considered exploratory given these limitations.

5. Conclusions

This study has shown that many of the concerns expressed in the literature about the eating behaviors of young adults, particularly those who are living on their own for the first time, may be overblown. Living arrangements appear to have little association with healthy eating, either in terms of number of daily servings and adherence to food guide recommendations. While results have shown that most students do not avoid unhealthy food choices (snacks or junk food), or do not necessarily eat the recommended number of servings from the food guide, this does not appear to be due to where they eat most of their meals. Rather, it appears to reflect their learned nutrition behaviors given that it is generally as prevalent among university students living at home with their parents as it is among those who are living independently, either on or off campus. While these results appear to support the status quo for university meal choices it does not mean that efforts should not be made to eliminate gaps in healthy eating or to educate people about healthy eating.

Nutrition gaps include overall limited intake of recommended food groups and, in particular, vegetables/fruits and grains groups. Exploring this further, these gaps also include the students' limited consumption of green and red/orange vegetables and whole grains, and the overconsumption of foods to limit: behaviors that transcend meal source.

While failure to meet recommendations for food groups is not a good thing, there is time for young adults to change their eating behaviors to ensure short and long-term health. Clear messaging is important to increase awareness of the opportunities available from the living and eating environments that will support healthy eating (Brug, et al, 2008). Emphasis should also be placed on university food services to encourage them to provide healthy food options and also to make healthy meals options more attractive and affordable (WHO, 2015c). University enrolments will continue to grow and more young people and their families will invest heavily in post-secondary education. Students are a captive audience. If university cafeterias can provide nutritious and innovative menu choices at affordable prices, the number of students choosing to eat more meals on campus is likely to grow, resulting in a win-win opportunity for students, universities and their food service providers. Future research should address other determinants of healthy eating. These may include students' knowledge and motivation to eat healthier, their concern for their health, their perceptions about their eating environments, and how on-campus healthy eating food options and promotions impact students' behaviors and health.

6. References

- American College Health Association. (2015). American College Health Association – National College Health Assessment II: Reference Group Executive Summary Spring 2015. Retrieved from http://www.acha-ncha.org/docs/NCHA-II_WEB_SPRING_2015_REFERENCE_GROUP_EXECUTIVE_SUMMARY.pdf
- Blotnicky, K., Mann, L. & Joy, P. (2015). An assessment of university students' healthy eating behaviors with the expectancy theory. *American Society of Business and Behavioral Sciences e-Journal*, 11(1), 31-44. Retrieved from http://asbbs.org/files/2015/eJournal_2015.pdf
- Boyle, J. R. & LaRose, N.R. (2009). Personal beliefs, the environment and college students' exercise and eating behaviors. *American Journal of Health Studies*, 23(4), 195-200. Retrieved from EBSCOhost Academic Search Premier database.
- Brown, L., Dresen, R. & Eggett, D. (2005). College students can benefit by participating in a prepaid meal plan. *Journal of the American Dietetic Association*, 105(3), 445-448. Retrieved from CRKN Elsevier ScienceDirect database.
- Brug, J., Kremers, S.P., van Lenthe, F., Ball, K. & Crawford, D. (2008). Environmental determinants of healthy eating: In need of theory and evidence. *Proceedings of the Nutrition Society*, 67, 307-316. doi: 10.1017/S0029665108008616
- Brug, J., van Lenthe, F.J. & Kremers, S.P.J. (2006). Revisiting Kurt Lewin: How to gain insight in environmental correlates of obesogenic behaviors. *American Journal of Preventive Medicine*, 31, 525-529. doi:10.1016/j.amepre.2006.08.016
- Brunt, A.R. & Rhee, Y.S. (2008). Obesity and lifestyle in US college students related to living arrangements. *Appetite*, 51, 615-621. doi: 10.1016/j.appet.2008.04.019
- Burrows, T., Goldman, S., Pursey, K. & Lim, R. (2016). Is there an association between dietary intake and academic achievement: A systematic review. *Journal of Human Nutrition and Dietetics*, 1-24. doi: 10.1111/jkn.12407
- Centers for Disease Control and Prevention. (2014). Health and Academic Achievement. Retrieved from http://www.cdc.gov/healthyyouth/health_and_academics/pdf/health-academic-achievement.pdf
- Centers for Disease Control and Prevention. (2015). Nutrition and Health of Young People. Retrieved from <http://www.cdc.gov/healthyschools/nutrition/facts.htm>
- Garriguet, D. (2007). Canadians' eating habits. *Health Reports. Statistics Canada, Catalogue 82-003*, 18(2), 17-32. Retrieved from <http://www.statcan.gc.ca/pub/82-003-x/2006004/article/9609-eng.htm>
- Health Canada. (2007). Eating Well with Canada's Food Guide. Retrieved from <http://www.hc-sc.gc.ca/fn-an/food-guide-aliment/index-eng.php>
- Jackson, R.A., Berry, T.R. & Kennedy, M.D. (2009). The relationship between lifestyle and campus eating behaviors in male and female university students. *College Student Journal*, 43(3), 860-871. Retrieved from EBSCOhost Academic Search Premier database.

- LaCaille, L.J., Dauner, K.N., Krambeer, R.J. & Pedersen, J. (2011). Psychosocial and environmental determinants of eating behaviors, physical activity, and weight change among college students: A qualitative analysis. *Journal of American College Health*, 59(6), 531-538. doi:10.1080/07448481.2010.523855
- Laska, M.N., Larson, N.I., Neumark-Sztainer, D. & Story, D. (2009). Dietary patterns and home food availability during emerging adulthood: Do they differ by living situation? *Public Health Nutrition*, 13(2), 222-228. doi: 10.1017/s1368980009990760
- Nelson, M.C. & Story, M. (2009). Food environments in university dorms: 20,000 calories per dorm room and counting. *American Journal of Preventative Medicine*, 26(6), 523-526. doi: 10.1016/j.amepre.2009.01.030
- Radwin, D. & Wei, C.C. (2015). What is the price of college? Total, net, and out-of-pocket prices by type of institution in 2011-12. U.S. Department of Education, Statistics in Brief. Retrieved from <http://nces.ed.gov/pubs2015/2015165.pdf>.
- Raine, K.D. (2005). Determinants of healthy eating in Canada. *Canadian Journal of Public Health*, 96(S3), S8-S14. Retrieved from ProQuest Research Library database.
- Rao, S.P., Lozano, V. & Taani, M. (2014). Cues to healthy decision-making among college students: results from a pilot study. *College Student Journal*, 48(8), 697-706. Retrieved from EBSCOhost Academic Search Premier database.
- Statistics Canada. (2013a, June 19). Canadian Community Health Survey 2011. The Daily. Retrieved from <http://www.statcan.gc.ca/daily-quotidien/120619/dq120619b-eng.pdf>
- Statistics Canada. (2013b, November). Public postsecondary enrolments and graduates, 2011/2012. The Daily. Retrieved from <http://www.statcan.gc.ca/daily-quotidien/131127/dq131127d-eng.htm>
- Statistics Canada. (2014). Fruit and vegetable consumption. Health Fact Sheets. Retrieved from <http://www.statcan.gc.ca/pub/82-625-x/2015001/article/14182-eng.htm>
- Statistics Canada. (2015, September). University tuition fees, 2015/2016. The Daily. Retrieved from <http://www.statcan.gc.ca/daily-quotidien/150909/dq150909b-eng.htm>
- U.S. Department of Education, National Center for Education Statistics. (2015). Digest of Education Statistics, 2013 (NCES 2015-011). Retrieved from <http://nces.ed.gov/fastfacts/display.asp?id=98>
- Vandevijvere, S., Chow, C.C., Hall, K.D., Umali, E. & Swinburn, B.A. (2015). Increased energy supply as a major driver of the obesity epidemic: A global analysis. *Bulletin of the World Health Organisation*, 93, 446-456. doi: <http://dx.doi.org/10.2471/BLT.14.150565>
- Vecchiarelli, S., Takayanagi, S. & Neumann. (2006). Students' perceptions of the impact of nutrition policies on dietary behaviors. *Journal of School Health*, 76(10), 525-531. doi: 10.1111/j.1746-1561.2006.00153.x
- Von Ah, D., Ebert, S., Ngamvitroj, A., Park, N. & Duck-Hee, K. (2004). Predictors of health behaviors in college students. *Journal of Advanced Nursing*, 48(5), 463-474. doi: 10.1111/j.1365-2648.2004.03229.x.
- World Health Organization. (2015a, January). Obesity and overweight. Media Centre Fact Sheet No311. Retrieved from <http://www.who.int/mediacentre/factsheets/fs311/en/>
- World Health Organization. (2015b, June). Epidemic of obesity and overweight linked to increased food energy supply study. *Bulletin of the World Health Organisation*. Retrieved from <http://www.who.int/bulletin/releases/NFM0715/en/>
- World Health Organization. (2015c, September). Healthy diet. Media Centre Fact Sheet No394. Retrieved from <http://www.who.int/mediacentre/factsheets/fs394/en/>