

Impact of Point of Sale Nutritional Information and Dietary and Exercise Habits of College Students in Missouri

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Abstract Poor dietary and exercise habits can lead to many negative health outcomes later in life. The eating and exercise behaviors of college students are of particular importance as many life-long habits are formed during this period in their lives. This study examined the current eating and exercise habits of traditional college students at a small liberal arts college in Columbia, Missouri. Traditional day students (N=884) were e-mailed a survey to their college assigned e-mail address, with 96 students completing the survey. Those who received the survey link had access to all campus resources, such as the gymnasium, dorms, and dining halls. 55.21% of respondents indicated that their current level of physical activity was less now than when they were a senior in high school. Even though the dining hall displayed nutritional information for all entrees, 26.32% of the students indicated that they were aware that the nutritional information was posted, 23.16% of students indicated that no nutritional information was posted, and 50.53% stated that they didn't know. Students who indicated that they were aware that the nutritional information was posted reported exercising on average 5.29 hours per week compared to 4.72 hours for those who reported no nutritional information was posted and 3.81 hours per week for those who reported they did not know. Students who were aware of the posted nutritional information also ate at fast food restaurants less often (2.68 times per week) than those who stated no information were posted (3.52 times per week) and those who did not know (4.38 times per week). Of the participants 25% reported that they are unaware of their daily-recommended caloric intake.

Keywords: eating habits, exercise habits, point of sale nutritional information, college students

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1. Introduction

Poor dietary and exercise habits can lead to negative health outcomes later in life. Poor eating habits are a serious public health issue that have both negative health and economic implications [1,2,3]. Links have been demonstrated between diet and numerous diseases such as cardiovascular disease, cancer, diabetes, and stroke [4,5]. Medical costs related to obesity have been estimated to exceed those of smoking in the United States [6]. Lost worker productivity in the US associated with morbidity from obesity-related diseases has been estimated at as much as \$400-600 billion, and is predicted to increase by \$48-66 billion per year by 2030 [7]. In 2011, more than two-thirds of US adults were overweight or obese, and one-third of adults were obese [8]. In 2014, worldwide, there were more than 1.9 billion overweight adults and, of those, 600 million were obese [9]. Encouraging better eating and exercise practices can benefit not only the individual, but society as well.

Dietary choices of college students are a concern because eating habits tend to become less healthy during college years [10-16]. The greatest increases in overweight and obesity seem to occur between the ages of 18 and 29 [17,18]. Eating habits of young adults are influenced by factors such as taste, cost, and convenience [19]. Behavioral changes also occur during this time period, which include lower rates of physical activity and poor nutritional choices, such as overeating [20-26].

Although many studies have focused on specific aspects of eating habits of college students, such as eating associated with stress [27] and depression [28,29,30,31] or binge eating [32,33,34,35], few have specifically examined the role environmental factors, such as point-of-selection nutritional information [36,37,38], play in affecting eating behavior. These limited studies have resulted in contradictory findings. For example, one study demonstrated that point-of-selection nutritional information significantly decreased the percentage of students consuming large portions of French fries [39]; while a separate study demonstrated that posting nutritional information in campus dining halls did not effectively change meal choices [38].

This study examined the current eating and exercise habits of traditional college students at a Midwestern college (which grants bachelors and masters degrees), as well as the relationship between awareness of point-of-selection nutrition information and health factors.

2. Materials and Methods

A hyperlink to an online survey was e-mailed to currently enrolled day students (N=884) on the main campus via their college assigned e-mail address during the Spring 2014 academic semester. Evening, online, and students attending satellite campuses were excluded from receiving the survey. Those who received the survey hyperlink are commonly referred to as “traditional” college students, attend classes in seat, and have access to campus resources, such as extracurricular clubs, sporting events, campus gymnasium, dorms, and dining halls.

The survey consisted of 48 questions and could be completed in approximately 10 minutes. The questions included topics such as overall health, level of physical activity, eating habits, meals consumed on campus, awareness of nutritional information posted in the dining hall, reasons for eating fast food, who initiates eating fast food, to items such as grade point average (GPA), on/off campus residence, number of roommates, alcohol consumption, sex, gender, and age. The survey was constructed with click and drop down boxes with values preloaded. The Institutional Review Board approved the study protocol and all participants provided written informed consent.

Students have access to three meals per day, seven days a week during the semester and summer school sessions at the on-campus dining hall. Meals are served buffet style with entrees and desserts varying daily. The dining hall posts nutritional information on an 8½” x 11” piece of white paper with black 32 point font approximately 12” above each entrée on the sneeze guard in an acrylic tabletop displayette. The information provided includes recommended serving size, fat content, carbohydrates, and calories of each entrée.

Body mass index (BMI) was calculated using the standard formula of (weight in kilograms)/(height in meters)². Participants’ self-reported weight and height were transformed from pounds and inches into kilograms and meters for the purpose of the calculation.

The dependent variable, overall level of health, was self-reported using a Likert-type scale (1= very unhealthy, 2= somewhat unhealthy, 3= average health, 4= somewhat healthy, and 5= very healthy). Participants were also asked their current level of physical activity (1= very inactive, 2= somewhat inactive, 3= average level of activity, 4= somewhat active, and 5= very active) and how many hours per week they exercised. An additional question of compared to their senior year in high school, how would they rate their current level of physical activity (1= significantly less now, 2= somewhat less now, 3= about the same, 4= somewhat more now, or 5= significantly more now) was also included on the survey. These items were used to measure level of one’s health.

Students were also asked about the frequency of visits to 14 popular national chain fast food restaurants. These establishments included those that have both a dining area

and drive through window. Pizza restaurants were excluded due to a lack of drive through window option. The fast food restaurants included were Arby’s, Burger King, Dairy Queen, Hardees, Jack in the Box, KFC, Lion’s Choice, Long John Silver’s, McDonald’s, Popeyes, Sonic, Taco Bell, Wendy’s, White Castle, and other. The variable ‘fast food per week’ was constructed by summing the total of all self-reported fast food visits. Data collected for the questions during the past 3 months, on average, how many servings per day did you consume fruits, vegetables, dairy (milk, yogurt, or cheese), grains (bread, cereal, rice, or pasta), and/or fats (fats, oils, or sweets) were used to construct the variables servings per day of each fruits, vegetables, dairy, grains, and fats. These items were used to determine dietary habits.

Cronbach’s alpha for the 12 level of one’s health and 6 dietary habit items were .58 and .49 respectively. Stata version 13.1 was utilized for this study.

3. Results

A total of 96 students participated in the survey, resulting in an 11% response rate. Females were the majority of the participants at 76%, with 56% of the total respondents resided on campus. Of the participants, 88% were white, 2% African American, 2% Hispanic, 3% Asian/Pacific Islander, and 4% other.

For self-reported overall level of health 39% of participants indicated they were somewhat healthy, with 26% reporting average health. Of the students 18% reported they were somewhat unhealthy, 2% reported very unhealthy, and 16% indicated they were very healthy. Participants in this study averaged 4.34 hours of exercise per week. The primary means of exercise were walking (31%) and running/jogging (23%). However, 55% of respondents indicated that their current level of physical activity is less now than when they were a senior in high school, with 37% reporting it is significantly less now. Only 30% of participants had increased their overall level of physical activity since their senior year of high school. Descriptive statistics can be seen in [Table 1](#).

Table 1. Descriptive statistics

Variable	mean	s.d.	min	max	n
Overall level of health (1=very unhealthy)	3.48	1.03	1	5	96
Overall level of physical activity (1=very inactive)	3.35	1.21	1	5	96
Level of physical activity since high school (1=significantly less)	2.48	1.41	1	5	96
Hours of exercise per week	4.34	3.81	0	19	94
Dining hall meals per week	7.40	6.57	0	21	96
Fast food meals per week	3.79	4.49	0	30	96
Fruit servings per day	1.87	1.49	0	8	95
Vegetables servings per day	2.05	1.51	0	6	95
Dairy servings per day	2.26	1.54	0	8	94
Grains servings per day	3.17	2.09	0	10	94
Fats servings per day	2.71	1.65	0	10	93
GPA	3.44	0.46	2	4	95
Age	21.72	4.74	18	56	94

While 62% of respondents fell within the healthy BMI range (18.5-24.9), 38% were classified as overweight or obese (BMI≥25), including 20% in the obese range

(BMI \geq 30). Underweight (BMI<18.5) occurred in 1% of the sample. BMI of college student participants by gender and grade level can be seen in Table 2. Of the participants 25% reported that they do not know what their daily-recommended caloric intake is, and 21% reported that it is less than 1500 calories per day.

Table 2. Mean (s.d.) BMI by gender and class

Variable	Male	n	Female	n
BMI (all grade levels)	25.25 (4.56)	22	24.85 (5.41)	71
BMI (freshman)	24.33 (-)	1	23.60 (4.70)	19
BMI (sophomore)	25.63 (2.84)	3	24.19 (3.93)	12
BMI (junior)	24.82 (3.32)	9	26.84 (6.24)	18
BMI (senior)	25.65 (6.40)	9	24.67 (5.84)	22

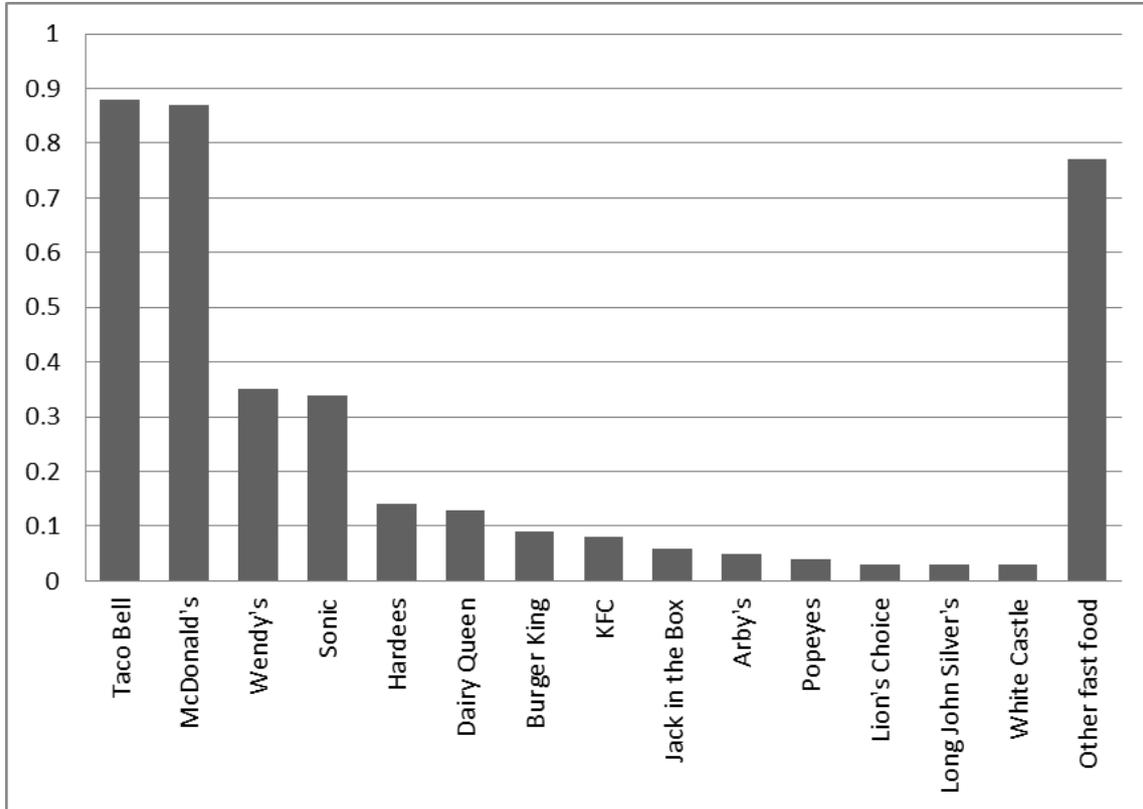


Figure 1. Fast Food Consumption per Week

Figure 1 illustrates the frequency of fast food consumption by participants. Taco Bell and McDonald's were the most frequented fast food restaurants, at just under one visit per week. Overall, students visited fast food restaurants an average of 3.79 times per week. Those residing in a residence hall on campus ate at a fast food restaurant more frequently than those who lived off campus, 4.21 times per week versus 3.46.

The primary reason for consuming fast food was convenience/time (67%), with quality/taste (11%) and price (5%) not being key motivating factors of dining at fast food. When asked who initiated dining at a fast food restaurant, 37% indicated they solely decided and 30% indicated a friend (excludes girlfriend, boyfriend, significant other) suggested it. As the primary recommender of dining at fast food restaurants, boyfriends were responsible 14% of the time, while girlfriends only recommended it 1% of the time.

Participants ate an average of 7.40 meals per week in the dining hall, compared to 16.56 meals at off-campus locations. Lunch was the most commonly consumed meal in the dining hall, with a mean of 3.14 times per week, followed by dinner (2.69 times per week), and breakfast (1.63 times per week). Dining out is commonplace among the participants as 83% prepare five or fewer meals in their residence, with 36% reporting that they do not prepare any meals at home.

Twenty-seven percent of the students indicated that they were aware that the nutritional information for meals was posted in the dining hall. Twenty-three percent of students indicated that no nutritional information was posted in the dining hall and 51% stated that they didn't know whether or not nutritional information was posted.

Students who indicated that they were aware that the nutritional information was posted reported exercising on average 5.29 hours per week compared to 4.72 hours for those who reported no nutritional information was posted and 3.81 hours per week for those who reported they did not know. Students who were aware of the posted nutritional information also ate at fast food restaurants less often (2.68 times per week) than those who stated no information was posted (3.52 times per week) and those who did not know the information was posted (4.38 times per week). However, there were no significant differences between the groups of students who were aware of nutritional information and average hours exercised ($p=.30$) or average fast food meals per week ($p=.33$).

A Pearson correlation coefficient (Table 3) was computed to assess the relationship between overall health and the variables physical activity, BMI, and consumption of fast food, fruits, vegetables, dairy, grains, and fats. Overall health was strongly correlated with the amount of physical activity per week ($r=.628, p<.05$) and BMI ($r=-.505, p<.05$). A moderate correlation existed between

overall health and vegetable servings per day ($r = .278$, $p < .05$). There was a weak negative correlation between overall health and fast food consumption per week ($r = -.111$), although not significant at the .05 level.

Table 3. Correlation of dietary and exercise habits

Variable	X ¹	X ²	X ³	X ⁴	X ⁵	X ⁶	X ⁷	X ⁸	X ⁹
Overall Health	1.000								
Level of Physical Activity	.628*	1.000							
BMI	-.505*	-.295*	1.000						
Fast Food per week	-.111	-.015	.059	1.000					
Fruit Servings per week	.178	.267*	.086	.096	1.000				
Vegetable Servings per week	.278*	.246*	.034	-.005	.669*	1.000			
Dairy Servings per week	.097	.100	.236*	.183	.375*	.213*	1.000		
Grain Servings per week	-.134	-.004	.252*	.120	.177	.153	.423*	1.000	
Fat Servings per week	-.120	-.126	.215*	.099	.005	.112	.263*	.595*	1.000

A strong correlation was also demonstrated between vegetable servings per day and fruit servings per day ($r = .669$, $p < .05$); and also between servings of grains per day and servings of fats per day ($r = .595$, $p < .05$).

An ordinary least squares regression was performed to evaluate how physical activity, number of meals eaten at

fast food restaurants per week, number of daily servings per week of fruits, vegetables, dairy, grains, and fats, and BMI predicted overall level of health. The eight predictors accounted for 54% of the variance in self-reported overall health of the college students, $F(8,82) = 12.25$, $p < .001$, $R^2 = .5444$. Further results are presented in Table 4.

Table 4. Ordinary least squares regression

Overall health	B	p	95% Confidence Interval
Level of physical activity	0.402 (0.069)	0.00	.2635553 .5399326
Fast food (per week)	-0.017 (0.018)	0.35	-.0519735 .0186438
Fruit (servings per day)	-0.082 (0.074)	0.27	-.2302495 .0658933
Vegetables (servings per day)	0.147 (0.068)	0.03	.0121214 .2811123
Dairy (servings per day)	0.127 (0.058)	0.03	.012848 .2418245
Grains (servings per day)	-0.031 (0.053)	0.56	-.1363547 .0741303
Fats (servings per day)	0.002 (0.058)	0.98	-.1145726 .1176925
BMI	-0.076 (0.016)	0.00	-.1080365 -.0442743
Constant	3.77 (0.499)	0.00	2.780792 4.766153

The variable with the largest influence on overall health was amount of physical activity per week ($B = .402$, $p < .05$). The next largest influencers were vegetables servings per day ($B = .147$, $p < .05$) and dairy servings per day ($B = .127$, $p < .05$). The variables that had the smallest degree of impact on self-reported overall health were the number of meals eaten at fast food restaurants per week ($B = -.017$) and fats servings per day ($B = -.002$). Both of these variables had little influence on overall health and neither was statistically significant.

4. Discussion

The current method of posting nutritional information in the dining hall has little effect on influencing the choice of entrées, as more than 50% of the students were unsure if such information was even displayed. Posting the information in an alternative location, or in a different manner that draws more attention may affect individual choices. College students who frequently read nutrition labels consume fast food at a lower frequency than those who do not [40]. Knowledge of fat and calorie levels may lead to smarter food choices.

These smarter choices may not only be restricted to dietary choices. Students who indicated they were aware

of the nutritional information postings reported exercising approximately 1.5 hours more per week than those who reported they did not know. This indicates that an overall awareness of nutritional and caloric intake may lead a student to incorporate additional healthy behaviors.

Government and healthcare organizations have taken steps to standardize the recommended amount and intensity of exercise. Both the World Health Organization and the Office of Disease Prevention and Health Promotion recommends that adults engage in at least 150 minutes per week of moderate-to-vigorous physical activity, accumulated in bouts lasting at least 10 minutes [41]. This equates to 2.5 hours of exercise per week. Students in this study exceeded the recommendation by 1.84 hours per week. Self-reported levels of physical exercise do raise validity concerns, as individuals tend to over-report activity [42], however, self-reported levels of physical activity have been found to be relatively reliable [42,43,44,45]. Reasonably valid measures of physical activity can be accessed by short, simple questions for epidemiological research [46,47].

In this study, amount of physical activity per week was the single strongest predictor of students' overall health. What is concerning is that more than 55% of the respondents indicated that their level of physical activity has decreased since high school. This trend, if continued,

can lead to serious health risks in the future. Colleges and universities must create initiatives that emphasize the importance of exercise and encourage physical activity to help prevent these future negative health outcomes and build strong exercise habits, such as incentives to regularly exercise and/or recreational opportunities such as intermural sports leagues.

An additional area of concern among college students is the number of students who are overweight and obese. Based on self-reported height and weight, 38% of respondents were overweight or obese, with 20% classified as obese. Of the participants, 61% fell in the normal BMI range. The students' reported mean BMI for freshman was 23.64, sophomores was 24.48, juniors was 26.16, and with seniors reporting a mean BMI of 24.95. Self-reported height and weight are accurate indicators of actual height and weight and are valid for the use in social science research [48-54].

Students reported consuming just fewer than four meals from fast food restaurants per week. The primary reason for consuming fast food meals is convenience, however ease of access may aid in developing poor dietary habits. Students who lived on campus ate at a fast food restaurant more frequently than those who lived off campus. This may be a result of the dining halls hours of operation not being open later in the evening, lack of kitchen area in the dorms, or an indication of student dissatisfaction with the quality of meals provided.

Although a weak correlation between overall health and fast food consumption exists, it may be the result of a lag effect in the negative health outcomes of consuming highly processed foods by college aged students. Negative health affects resulting from frequently consuming fast food may not occur until after students leave college.

5. Conclusions

Alternative content for nutritional postings may be more effective in encouraging healthier choices, such as simply indicating which items are healthier alternatives in lieu of listing actual caloric, fat, and carbohydrate content. At one on-campus convenience store, food items marked as 'healthier' resulted in an increased level of sales of those items [55]. This general form of providing nutritional guidance in food choices may produce better results as 27% of students did not know nutritional information was posted, 51% of the students were unsure if such information was even displayed, and 25% of students were unaware of what their daily-recommended caloric intake should even be.

Poor eating and exercise habits can lead to severe negative health outcomes as people age. Building and reinforcing positive eating and exercise habits while young adults are in college can lead to lifelong practices that may mitigate many serious health issues later in life.

This study is not without some limitations. Students who live healthier lifestyles may be more apt to participate and complete surveys relating to eating and exercise habits. Variables such as student height and weight cannot be collected through venues such as student health services due to privacy issues therefore self-reported measures were used. Also, the sample from one college in the

Midwest raises external validity issues. Future research should include more diverse higher educational settings.

Statement of Competing Interests

The authors have no competing interests.

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