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E. Wells

M. Avery

B. Catanzarito

B. Wilson

J. Bunn

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Original Article

**Assessment of breakfast and physical activity habits in college students at a rural private institution**

ELIZABETH K. WELLS, MEGAN L. AVERY, BROOKE R. CATANZARITO, BRANDON N. WILSON, JENNIFER A. BUNN

Department of Exercise Science, Campbell University, UNITED STATES OF AMERICA

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**Abstract:**

**Problem Statement:** Breakfast is considered the most influential meal and a key component of weight control, but it is believed that many college students tend to skip this meal. **Purpose:** To assess relationships between breakfast habits, body composition, and physical activity in undergraduate college students at a rural private university. **Approach:** Undergraduate college students (n = 197) completed a survey about breakfast and physical activity habits and completed body composition and body mass index (BMI) assessments. A chi-square analysis was used to determine the relationships between survey responses, body composition, and BMI. **Results:** The analysis revealed that the greater number of days of physical activity participation the more often breakfast is consumed ( $p < .001$ ), athletes consume breakfast more frequently than non-athletes ( $p = .01$ ), and on-campus students consume breakfast less frequently than off-campus students ( $p = .026$ ). **Conclusions:** Some recognized themes from the data suggest that undergraduate students who consumed breakfast consistently chose healthier breakfast foods, off-campus students had better access to breakfast foods compared to on-campus students, and athletes consumed breakfast more frequently due to greater energy needs. These results suggest that college students who participate in at least one healthy lifestyle habit are likely to participate in more, and these healthy habits established in young adulthood can translate into lifelong health.

**Keywords:** physical activity, exercise, breakfast, body composition, obesity

**Introduction**

Breakfast is traditionally known as “the most important meal of the day,” and skipping breakfast is commonly linked with overweight individuals and higher body mass index (BMI) in adolescents (Corder et al., 2011; Giovannini et al., 2008; Matthys, De Henauw, Bellemans, De Maeyer, & De Backer, 2007; Nurul-Fadhilah, Teo, Huybrechts, & Foo, 2013; Rampersaud, Pereira, Girard, Adams, & Metz, 2005; Tin, Ho, Mak, Wan, & Lam, 2011). Obesity is prevalent in developed countries and continues to increase while physical activity and breakfast intake have both decreased (Giovannini, et al., 2008). Breakfast provides around 20-25% of daily energy needs (Romero-Sandoval et al., 2013); thus, skipping breakfast tends to result in lethargy and decreased physical activity throughout the day (Berkey, Rockett, Gillman, Field, & Colditz, 2003; Clayton, Stensel, & James, 2016; Corder, et al., 2011).<sup>9</sup> Additionally, skipping breakfast has been shown to impair exercise performance later in the day, with total work decreased by 4.5% (Clayton, et al., 2016). In contrast, those who do eat breakfast tend to consume more micronutrients and less fat than those who do not, which promotes cognitive function, attention, concentration, psychosocial function, and academic performance (Gajre, Fernandez, Balakrishna, & Vazir, 2008; Gibson & Gunn, 2011; Giovannini, et al., 2008; Halsey et al., 2012; Matthys, et al., 2007; Rampersaud, et al., 2005).

Routine breakfast habits are linked with regular eating and exercise habits (Matthys, et al., 2007). Halsey et al. (2012) showed that when participants ate breakfast, they tended to exercise longer and created a negative energy balance despite ingesting more overall food and beverage. By including breakfast, an increase of meal frequency occurs, which has been proven to induce a change in metabolism that may improve chronic disease risk factors and decrease appetite and energy intake (Giovannini, et al., 2008; Rampersaud, et al., 2005). Consuming breakfast is shown to improve metabolism and result in more energy; however, a high fat breakfast does not result in the same benefits as a well-balanced breakfast (Giovannini, et al., 2008). An ideal breakfast consists of a variety of foods that are high-fiber, nutrient-rich whole grains, fruits, and dairy products (Matthys, et al., 2007; Nurul-Fadhilah, et al., 2013; Rampersaud, et al., 2005). Specifically, the inclusion of high-fiber complex carbohydrates improves insulin sensitivity and promotes satiety (Alwattar, Thyfault, & Leidy, 2015; Giovannini, et al., 2008; Vander Wal, Gupta, Khosla, & Dhurandhar, 2008). This concept proves to be especially true especially in athletes. Aerenhouts et al. (Aerenhouts, Hebbelinck, Poortmans, & Clarys, 2008) found that specific breakfast choices impacted body composition in adolescent sprint athletes specifically. Regular and

health conscience breakfast choices can promote an overall well balanced diet that can prevent chronic disease risk factors, improve metabolism, and increase energy throughout the day.

Many dietary habits are established during adolescence and are influenced by family and lifestyle. Previous literature has proven that poor breakfast habits established during childhood and adolescence are associated with a high risk for obesity in adulthood, which also increases the probability of early aging and chronic diseases (Gikas, Triantafillidis, & Perdikaki, 2003; Nurul-Fadhilah, et al., 2013). Poor habits that tend to occur in adolescence include increased sedentary activities (Fernandez-Alvira et al., 2013; Giovannini, et al., 2008), eating fast food, snacking too often, and irregular meals (Kilinc & Cagdas, 2012). These habits that begin in adolescence will likely continue into adulthood. Further, former studies that have focused on breakfast skipping have shown that the students' poor breakfast habits stemmed from prior lifestyle habits (Ackuaku-Dogbe & Abaidoo, 2014) and demonstrated similar reasoning including finances, lack of time, and lack of appetite (Corder, et al., 2011).

There have been conflicting results in studies on the exact role of breakfast habits' influence on body composition (Corder, et al., 2011; Rampersaud, et al., 2005; Tin, et al., 2011). Nurul-Fadhila et al. (2013) found that adolescents who did not eat breakfast daily increased their risk for excessive body fat as well as overall risk of obesity. An important finding of this study was that girls reported skipping breakfast because of weight gain concerns. Other studies have also found that girls face a greater risk of increased body composition due to infrequent breakfast consumption in comparison to males as well as lower physical activity (Corder, et al., 2011; Romero-Sandoval, et al., 2013). Matthys et al. found that adolescents who consumed a high quality breakfast that included all three target food groups (cereal products, dairy, and fruits and vegetables) had a better overall diet (Matthys, et al., 2007). High fat breakfast consumption has increased markedly, and the energy from these foods is stored as adipose tissue when there is little to no physical activity to combat weight gain (Kilinc & Cagdas, 2012; Ko, 2007).

Obesity has become the biggest global health crisis of the 21<sup>st</sup> century, and the World Health Organization estimates that 10% of the world's children ages 5-17 are overweight or obese (Romero-Sandoval, et al., 2013). Therefore, it is crucial to establish and promote dietary habits, healthy food choices, and physical activity in adolescence and young adults in order to prevent obesity-related diseases and promote psychological well-being (Kim, Sung, Park, & Dittmore, 2015; Ko, 2007; Nurul-Fadhilah, et al., 2013). The primary purpose of this study was to establish breakfast food habits, food choices, and physical activity participation in undergraduate college students at a rural, private university in the southeast United States. A secondary purpose was to evaluate the relationship between breakfast habits, physical activity habits, and body composition in these students. The combination of assessing breakfast habits with body composition will help to develop an accurate indication of how these lifestyles relate to health in undergraduate college students.

## **Materials & methods**

### *Participants*

There were a total of 197 undergraduate college participants for this study (male: 90, female: 107). All of the participants were between the ages 18–40, with an average age of  $20.1 \pm 2.49$  years. Participants were recruited via word of mouth by research personnel as well as through formal class invitation, which consisted of an announcement made by a research team member in a classroom setting. Eligibility criterion for the study was that each participant be at least 18 years old and enrolled as a full-time student at the rural, private university. Prior to participating in the study, each subject completed university-approved documents. These documents included a consent form for the Institutional Review Board. All subject participated at his or her own free will.

### *Procedures*

Participants completed an eleven-question survey to determine self-reported breakfast and physical activity habits. This survey included questions about living on or off campus, participation in a meal plan, if participants were a student athlete, physical activity habits including how often they exercise and the approximate length of the exercise session, how often they consumed breakfast, what time they generally ate breakfast, and what food items they typically chose for breakfast. Surveys were distributed to participants in a classroom setting upon completion of a consent form. After the students completed the survey, height, mass, and body composition of each individual was measured. Body composition was measured using an InBody 570 bioelectrical impedance analysis (BIOSPACE, Cerritos, CA). Body mass index (BMI) was also calculated using the height and mass data using a calibrated Health-O-Meter (Sunbeam Products Inc., Boca Raton, FL) scaled and stadiometer.

### *Statistical analysis*

Frequencies were calculated for each survey response and means were calculated for open-ended survey responses, BMI, and body composition. Relationships between breakfast habits, physical activity habits, campus living, classification as an athlete, body composition, and BMI were assessed using a chi-square test of independence. Specifically, a chi-square analysis was run comparing frequency of breakfast consumption to BMI, percent body fat, frequency of physical activity participation, duration of physical activity participation, meal plan, athletic status, gender, race, and housing status. Further chi-square analyses addressed food selection

and athletic status, frequency of physical activity participation, and type of housing. All statistics were calculated using SPSS Statistics 19 (IBM, Armonk, NY). Alpha level was set at 0.05 for significance.

## Results

Participant demographics for the study are shown below in Table 1, giving the average and standard deviation values for age, height, weight, BMI, and percent body fat. The average BMI categorizes the male participants as overweight while female participants demonstrated a normal average BMI. The male participants demonstrated an average percent body fat while the female participants demonstrated a poor average percent body fat. Both BMI and percent body fat values were based on the American College of Sports Medicine (ACSM) fitness categories for body composition (Pescatello, 2014).

Table 1. Mean  $\pm$  standard deviations (SD) from 107 females and 90 males for age, height, weight, BMI, and percent body fat (PBF) of participants.

Gender	Age (yrs)	Height (cm)	Weight (kg)	BMI (kg/m <sup>2</sup> )	PBF (% fat)
Female	20.0 $\pm$ 2.7	164.7 $\pm$ 7.37	65.2 $\pm$ 12.3	23.9 $\pm$ 0.71	28.0 $\pm$ 1.3
Male	20.3 $\pm$ 2.17	179.2 $\pm$ 11.2	85.8 $\pm$ 20.2	26.6 $\pm$ 0.78	17.3 $\pm$ 1.5
Total	20.1 $\pm$ 2.5	171.3 $\pm$ 11.8	74.6 $\pm$ 19.4	25.1 $\pm$ 4.7	23.1 $\pm$ 9.9

Figure 1 is a pie graph displaying data regarding physical activity participation frequency and duration. A majority of the participants exercise 3-6 days per week, with a third of the participants exercising 3-4 days/week and another third of participants exercising 5-6 days/week. A majority of participants exercise for 31-90 minutes when they exercise.

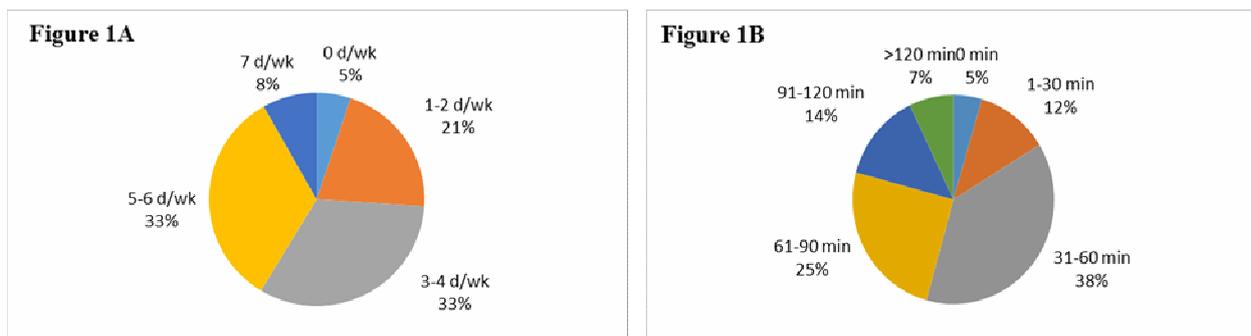


Fig. 1. A) Frequency of weekly physical activity among undergraduate college students, B) Duration of weekly physical activity participation among undergraduate college students.

Figure 2 is a pie graph displaying the frequency of breakfast consumption among participants from a range of no breakfast consumption to consuming breakfast daily. This chart shows the distribution is fairly even in all categories except no breakfast consumption, which only consisted of four percent of our participants. The students reported the typical time of breakfast consumption with the options before six in the morning until noon. The majority of participants, 65% reported consuming breakfast between eight and ten in the morning, with 25.4% consuming breakfast between six and eight in the morning, 7.6% eating between 10 am and noon, and 2.0% eating before 6 am.

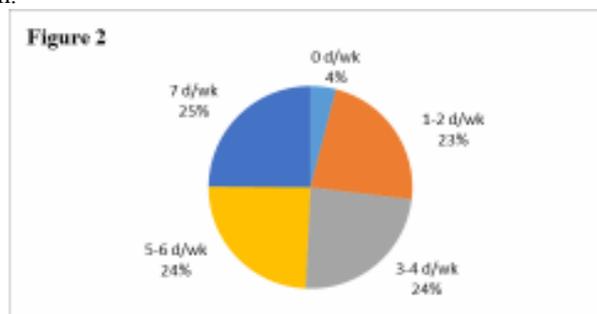


Fig. 2. Frequency of weekly breakfast consumption among undergraduate college students.

The chi-square analyses revealed no significant difference between frequency of breakfast consumption and BMI ( $p = .703$ ) or percent body fat ( $p = .205$ ). There was a significant association between frequency of breakfast consumption with frequency of physical activity participation ( $p < .001$ ), but not with duration of the exercise session ( $p = .086$ ). Table 2 displays the frequency of physical activity and the frequency of breakfast consumption, and is representative of the chi-square analysis that was conducted for these two measures. This

table demonstrates that more frequent physical activity was related to more frequent breakfast consumption, specifically in the 3-4 days/week and the 5-6 days/week.

Table 2. Percent of participants indicating participating in breakfast consumption and physical activity frequency. These data indicate that college students who do not consume breakfast regularly, also do not tend to participate in physical activity regularly. The higher the frequency of breakfast consumption, the more likely students were to also participate in regular physical activity that met the minimum ACSM requirements for frequency.

Breakfast	Physical Activity					Total
	0 d/wk	1-2 d/wk	3-4 d/wk	5-6 d/wk	7 d/wk	
0 d/wk	0.5	2	0	1.5	0	4.1
1-2 d/wk	1.5	9.1	8.6	3	0.5	22.8
3-4 d/wk	2	5.1	8.6	7.6	0.5	23.9
5-6 d/wk	0.5	2.5	7.1	10.7	3.6	24.4
7 d/wk	0.5	2	8.6	10.2	3.6	24.9
Total	5.1	20.8	33	33	8.1	100

The chi-square analysis showed a significant association between frequency of breakfast consumption with housing status ( $p = .026$ ) and athletic status ( $p = .01$ ). Figure 3A is a comparative bar graph that compares breakfast consumption with the type of student housing. The figure shows that on-campus students consume breakfast less frequently than off-campus students. Off-campus students were most likely to eat breakfast daily while on-campus students were most likely to eat breakfast 3-6 days/week. It is important to note that there were less student that participated in the study than non-student athletes (on-campus housing: 130, off-campus housing: 67). Figure 3B is a comparative bar graph comparing breakfast consumption with the athlete or non-athlete designation. Student athletes consumed breakfast more frequently than non-athletes. No athletes reported not eating breakfast and were mostly likely to eat breakfast more frequently than non-athletes. There was no association found between frequency of breakfast consumption and type of meal plan students had ( $p = .076$ ) or gender ( $p = .151$ ). It is important to note that there were less student athletes that participated in the study than non-athletes (athletes: 51, non-athletes: 146).

Certain breakfast food choices were linked with various behavior patterns and populations. Participants that consumed yogurt had a greater tendency to exercise 3-6 days/week ( $p = .051$ ), and participants that consumed a breakfast shake participated in exercise 5-7 days/week ( $p = .005$ ). A difference between athletes and non-athletes ( $p = .012$ ) showed that non-athletes were more likely to choose pancakes, waffles, or French toast than athletes. The results showed that those completing physical activity more often tended to consume healthier breakfast foods. There was no association found between breakfast food choices and type of housing.

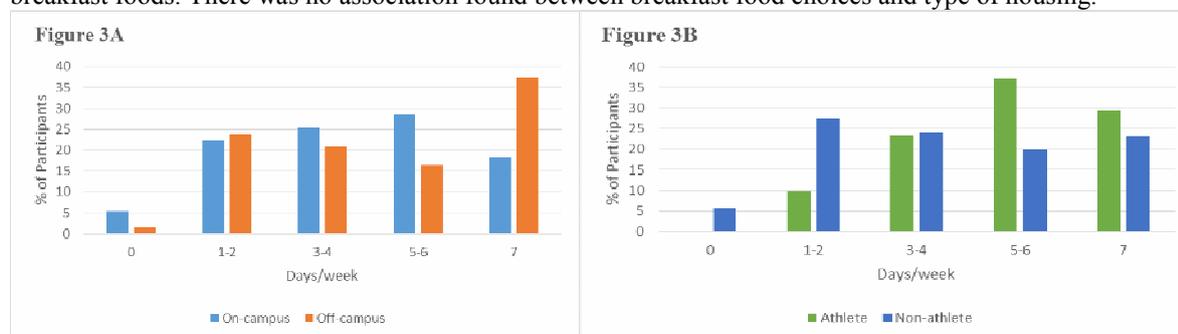


Fig. 3. A) Percentage of students indicating their frequency of breakfast consumption by housing type. Chi-square analyses revealed a significant relationship ( $p = .026$ ) between housing type and breakfast consumption, with more off-campus students consuming breakfast 7 d/wk. B) Percentage of students indicating their frequency of breakfast consumption by designation of athlete or non-athlete. Chi-square analyses revealed a significant relationship ( $p = .01$ ) between athlete designation and breakfast consumption, with athletes consuming breakfast more d/wk than non-athletes.

## Discussion

This study sought to assess the breakfast and physical activity habits of undergraduate students and address associations between these habits with body composition, BMI, and various student populations. Results indicated that more days of physical activity participation led to more frequent breakfast consumption, off-campus students ate breakfast more frequently than on-campus students, and student athletes consumed breakfast more often than non-student athletes. These findings agree with previous research that found high breakfast frequency is linked with increased physical activity (Corder, et al., 2011; Halsey, et al., 2012), and that athletes tend to consume an overall healthier diet (Aerenhouts, et al., 2008). In this aspect, a regular breakfast could prevent or help combat the tendency for obesity or bad health habits (Corder, et al., 2011; Giovannini, et al., 2008; Matthys, et al., 2007; Nurul-Fadhilah, et al., 2013; Rampersaud, et al., 2005; Tin, et al., 2011), but an

association with frequency of breakfast consumption and healthy BMI and body composition were not shown in this study. This may be because there was not much variation of the participants in either BMI or body composition, so very fit or overweight/obese populations were likely not well represented.

To our knowledge, this is the first study to report on frequency of breakfast consumption between on-campus and off-campus students. The frequency of off-campus breakfast consumption was significantly higher than on-campus breakfast consumption. The present study focused on undergraduates; therefore, many of these students resided in on-campus dormitories or apartments (66%). Ultimately, this study suggests that off-campus students had better accessibility to breakfast foods when compared to on-campus students living in dormitories that do not have access to a full kitchen and must travel to dining halls to use campus meal plans.

The significance of student athletes consuming more breakfast is likely due to their need for energy in their sport. Breakfast provides around a quarter of the needed daily energy (Romero-Sandoval, et al., 2013), which is critical for student athletes. Skipping breakfast is associated with lethargy and lack of energy (Ackuaku-Dogbe & Abaidoo, 2014; Corder, et al., 2011); therefore, these results from student athletes are not surprising. Due to the bond formed as a team along with having similar schedules, athletes are more likely to eat breakfast and other meals together, along with their teammates holding them accountable for maintaining healthy habits. Additionally, because athletes are likely to eat with their teammates, they are more likely to feel comfortable eating at campus dining halls as opposed to non-athlete students who may have to eat alone. It is also possible that some coaches required some athletes to attend breakfast at the university cafeteria, but this was not addressed in the survey.

This study also observed that students who consumed breakfast daily had overall better healthy food choices and nutrient profile, which is supported by previous literature (Matthys, et al., 2007; Rampersaud, et al., 2005). Previous literature found that quality breakfast habits (whole grains, fruit, vegetables, milk) resulted in an overall healthier diet with a low intake of soft drinks (Aerenhouts, et al., 2008; Kilinc & Cagdas, 2012; Matthys, et al., 2007). Fiber and macronutrient intakes provide particular importance in achieving good overall health with a variety of quality foods (Rampersaud, et al., 2005). The present study showed that individuals who exercise more frequently also tend to be more likely to choose yogurt and breakfast shakes for breakfast. Another significant result was that non-athlete students were more likely to choose pancakes, waffles, and French toast than student athletes. The non-athlete students typically exercised less often than a student athlete; however, the results did not indicate markedly less exercise. High fat foods typically lead to lethargy and less physical activity throughout the day, which is why it's not surprising that these foods are not typically consumed by student athletes (Ackuaku-Dogbe & Abaidoo, 2014; Corder, et al., 2011). The results from this study demonstrated that those undergraduate students who exercise more frequently tended to consume breakfast more often and make healthier breakfast choices. The prevalence of regular physical activity associated with consistent breakfast habits indicates that healthy habits are an important objective in the subject population that consistently ate breakfast and exercised, 54% subjects are exercising 3-6 days per week, and 63% are exercising between 31-90 min, which follows the ACSM recommendations for exercise (Berkey, et al., 2003). The breakfast choices of yogurt and breakfast shake were significant with consistent physical activity, which supports that healthy habits were important in the majority of the subject population. Limitations of this study include the study population was focused in the same private university, and all participants volunteered providing a convenient population sample. There was some confusion when students completed the breakfast habits survey. The directions of the survey instructed the students to check any food choices that the student typically consumed in one breakfast meal. However, some students chose any type of breakfast food consumed. Another limitation was in the method of self-reported data collection, which the accuracy and truthfulness in the answers are not able to be determined.

## Conclusions

The current study suggests that college students who participate in at least one healthy lifestyle habit are likely to participate in more due to the significant association found between the number of days that breakfast was consumed, number of days of physical activity participation, and healthy food choices that were made at breakfast. All three of these behaviors promote a healthy lifestyle. Previous literature reaffirms the significance of a nutritional breakfast on body composition and physical activity; however, this study did not support the same significance. Fostering healthy breakfast habits can help to prevent obesity and the development of chronic diseases associated with obesity (Ko, 2007). Instituting a nutritional breakfast can also help to combat obesity and weight-loss. Increasing meal frequency has been proven to increase satiety and provides increased energy throughout the day (Corder, et al., 2011; Halsey, et al., 2012). In this study, the subject population demonstrated healthy exercise habits with significant healthy breakfast choices. Healthy lifestyle strategies were present in this subject population, which influenced the lack of significance of body composition data. Previous literature found that skipping breakfast led to poor body composition and indicates the prevalence of poor breakfast and health habits outside of this study (Aerenhouts, et al., 2008; Corder, et al., 2011; Giovannini, et al., 2008; Matthys, et al., 2007; Nurul-Fadhilah, et al., 2013; Rampersaud, et al., 2005; Tin, et al., 2011). In order to withstand and reverse the global obesity epidemic that is occurring in modern society, nutritional and healthy lifestyle education should be improved to include food content conscience decisions (Kilinc & Cagdas, 2012; Nurul-

Fadhilah, et al., 2013), physical activity habits (Botelho, Agular, & Abarantes, 2013; Ko, 2007), and overall nutritional habits, which includes breakfast habits that can be promoted in adolescence in order to prevent adult obesity and the development of chronic disease (Frank, 2009).

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