

Changes in Women's Physical Activity During the Transition to College

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ABSTRACT

Background: Few studies have examined physical activity during the transition from high school to college. **Purpose:** To examine changes in physical activity and physical activity patterns among females during the transition from high school to college. **Methods:** Sixty-nine females (age 18.2 ± 0.4 years; body mass index 21.8 ± 2.6 kg/m²; 84% Caucasian) at a large university in the south central United States participated in this prospective longitudinal study. They completed a questionnaire at the beginning of their freshman and sophomore years of college, recalling their participation in physical activity during the previous 12 months. **Results:** Weekly time spent in moderate, vigorous, and moderate-to-vigorous physical activity declined between high school and college ($p < 0.01$). Physical activity participation also differed by semester ($p < 0.01$), with a significant decline during the summer between high school and college ($p < 0.01$), and an additional decrease during the first semester of college ($p < 0.01$). **Discussion:** Participants' physical activity significantly decreased from high school to college, with the largest decline occurring during the summer between high school and college. **Translation to Health Education Practice:** The transition from high school to college is a critical time to promote physical activity among women.

BACKGROUND

Regular participation in physical activity provides individuals with many health benefits, including reduced risk of coronary heart disease, hypertension, type 2 diabetes, colon cancer, anxiety and depression.¹ These health benefits may be obtained by meeting the current public health physical activity recommendation, which calls for all adults to accumulate 30 minutes of moderate-intensity aerobic physical activity on at least 5 days of the week, or 20 minutes of vigorous-intensity aerobic physical activity on at least 3 days of the week.² Moderate and vigorous-intensity activities may be combined to meet the recommendation.² Although regular participation in physical activity conveys numerous health benefits, approximately 70% of American adults do not engage in sufficient amounts of physical

activity to meet the recommendation.³

Physical activity participation is highest during childhood⁴ and declines with age.⁵⁻⁷ The sharpest reduction occurs during the transition from late adolescence to early adulthood.⁵ While 27% of 9th-grade students fail to meet recommended physical activity guidelines,⁸ 56–80% of college students do not participate in regular physical activity.^{9,10}

Although physical activity participation is lower among college students than high school students, few studies have been conducted to assess changes in physical activity during the transition from high school to college. In addition, the majority of previous studies have used cross-sectional research designs and focused on vigorous physical activity only. Baranowski et al.¹¹ suggested that the transition out of high school can

impact health because many behaviors, including physical activity, become altered due to changes in interpersonal relationships, living arrangements, employment,

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and educational pursuits. Bray and Born¹² reported that 33% of college students in their study engaged in lesser amounts of vigorous physical activity during their first 8 weeks of college than in their last 8 weeks of high school. Similarly, Leighton and Swerisen¹³ found that 42% of college freshmen perceived that their activity levels declined from their final year in high school.

As early as childhood, females consistently spend less time participating in physical activity than their male counterparts, with this trend continuing into high school and college.^{3,6,9,14} Because many of the major life and social role changes that occur during the transition to college are experienced differently by males and females,¹⁵ and because females are less physically active than males, it is important to assess the behaviors of women separately.

PURPOSE

The purpose of this study was to examine changes in physical activity patterns among females during the transition from high school to college.

METHODS

Participant Recruitment and Eligibility

“The Freshman Fifteen” was a prospective cohort study conducted to examine changes in body weight/composition¹⁶ and physical activity¹⁷ among female students during their first year of college. Participants’ progress was followed into their sophomore year.

After obtaining approval from the institutional review board, the researchers recruited freshman women attending a large, public university in the south central United States, using announcements to large general education classes, flyers posted across campus, and mass e-mail. Students were instructed to contact the researchers via e-mail or telephone to determine eligibility and schedule an appointment to begin the study. Eligible participants were freshman female students between 18 and 21 years of age enrolled full-time. Students were excluded if they (1) were pregnant or planning to become pregnant during

the study period, (2) were members of an intercollegiate athletic or organized sports team, (3) had a metabolic disease (e.g., Cushing’s Syndrome), or (4) were taking medication that affects body weight and composition (e.g., steroids, growth hormone, ephedrine, nicotine).¹⁶

In fall 2004, 171 freshman women completed the initial assessment session,¹⁶ with 71 (42%) returning for the follow-up session in Fall 2005. Of those who did not return, one became pregnant, three transferred, three were no longer attending the university, one was studying abroad, and 92 did not respond to multiple (3–5) telephone calls or electronic messages to schedule a follow-up session. Our retention rate is consistent with another longitudinal study of college students.¹⁸

Instruments

The Modifiable Activity Questionnaire for Adolescents (MAQA)¹⁹ was used to assess physical activity. The MAQA is a self-report instrument that requires participants to recall all leisure-time physical activity engaged in at least 10 times during the previous 12 months. Participants also indicate which month(s) they performed each activity and the number of months per year, days per week, and minutes per day that they engaged in each activity.

The MAQA was adapted from the Modifiable Activity Questionnaire.²⁰ The two questionnaires are very similar; however, the Modifiable Activity Questionnaire includes questions regarding occupational and leisure-time physical activity, while the MAQA inquires about leisure-time physical activity only. We used the MAQA because it was the most appropriate historical recall questionnaire for our target population.

Aaron et al.¹⁹ examined the validity and reliability of the MAQA in 100 adolescents ages 15–18 years. An average physical activity summary score obtained from four weekly recalls of physical activity completed every three months during the year served as the criterion measure. Validity indices ranged from 0.76 to 0.84, and one-month test-retest reliability was acceptable ($r=0.79$).

Procedures

Eligible participants attended an initial assessment session during the first 6 weeks of their freshman year of college. During this session, they completed an informed consent form, a short demographic questionnaire, and the MAQA. The MAQA required them to report their physical activity participation during the previous 12 months (i.e., senior year of high school and summer between high school and college). In addition, the researchers measured height (using a stadiometer) and weight (using a physician’s balance beam scale) to determine body mass index (BMI). All baseline data were collected between August 24 and October 3, 2004.

Participants attended a follow-up session at the beginning of their sophomore year. During this session they completed the same questionnaires that were administered at the initial assessment session, recalling their physical activity during the previous 12 months (i.e., freshman year and summer between freshman and sophomore years). All follow-up data were collected between September 9 and September 28, 2005. The mean number of days between assessment sessions was 373.1 ± 11.7 days (53.3 ± 1.7 weeks), with a range of 347–395 days (49.6–56.4 weeks).

Data Analysis

The hours per week that participants averaged over the previous year for each activity were calculated for data collected at both sessions using the following equation: (number of months of the activity) \times (4.3 weeks per month) \times (number of days per week of the activity) \times (number of minutes per day of the activity) \div (60 minutes per hour) \div (52 weeks per year) = hours per week of activity averaged over the past year.¹⁹

MET hours per week were also computed as an estimate of energy expenditure. The MET level indicates the intensity of an activity and is used to estimate energy expenditure without the potentially confounding influence of body weight (i.e., heavier individuals expend more energy doing the same activities as lighter individuals). One MET is equal to the resting metabolic rate of an individual, which is approximately 3.5



ml of oxygen per kilogram of body mass per minute or approximately 1 kcal per kilogram of body mass per hour.²¹ For example, physical activities of 4 METs require energy expenditure four times the resting metabolic rate. The MET levels for each activity were assigned using the Compendium of Physical Activities.²² After intensity was determined, a summary estimate of energy expenditure (MET hours per week) was computed by multiplying the hours per week of each activity by the activity's MET value. Activities requiring 3.0–5.99 METs were classified as moderate intensity, while those requiring at least 6.0 METs were categorized as vigorous intensity.¹ Total time spent in moderate, vigorous, and moderate-to-vigorous physical activity was determined by summing the time spent in activities within each intensity category. In addition, MET hours per week values were summed across activities to determine total MET hours per week of at least moderate-intensity activities.

The percentage of participants meeting the current physical activity recommendation was determined. Participants averaging at least 7.5 total MET hours per week [(150 minutes per week x 3 METs) ÷ 60 minutes per hour] of moderate-to-vigorous activities were categorized as meeting the recommendation, and those averaging less than 7.5 were categorized as failing to meet the recommendation.²

Patterns of physical activity across six semesters were also examined for the 2-year period. The fall semester of high school and college included the months of September through December, spring included January through April, and summer included May through August. Monthly moderate, vigorous, and total physical activity were summed across each 4-month semester and divided by 4 to create the average amount of physical activity performed for a given semester.

Descriptive statistics were calculated for all demographic and physical activity variables. Data from two participants were excluded due to outliers (total MET hours per week values greater than 3 standard deviations above the mean), resulting in a final sample of 69 participants. Independent

t-tests and chi-square tests were used to compare those who completed both assessments (n=69) to those who did not (n=100). Paired t-tests were calculated to compare physical activity between the two sessions. The proportion of participants meeting physical activity recommendations was compared between sessions using McNemar's test. Repeated measures analysis of variance with pairwise comparisons was used to assess physical activity patterns across the six semesters (i.e., from fall semester of senior year in high school to summer semester after the freshman year in college).

RESULTS

Participants

Age, BMI, credit hours, race, residence, and total MET hours per week did not differ between the 69 participants who completed both assessments and those who did not (n=100; $p>.05$). At the initial assessment, participants in this study were 18.2 ± 0.4 years of age, and weighed 59.1 ± 8.4 kg, with a BMI of 21.8 ± 2.6 kg/m². They were enrolled in 14.5 ± 1.4 academic credit hours, and approximately 96% were living in residence halls. The majority were Caucasian (n=58, 84%), which was representative of the university's freshman female class ($\chi^2=2.04$ [1], $p=0.15$).

Physical Activity Changes from High School to College

Weekly time spent in moderate ($t=4.24$ [68], $p<0.0001$), vigorous ($t=2.83$ [68], $p=0.006$), and moderate-to-vigorous physical activity ($t=5.54$ [68], $p<0.0001$) during the past year significantly declined between the senior year of high school and freshman year of college. Total MET hours per week of moderate-to-vigorous physical activities also decreased ($t=5.18$ [68], $p<0.0001$). Participants' physical activity during their senior year of high school and freshman year of college is presented in Table 1.

The proportion of participants meeting the current physical activity recommendation was also examined during this transition period (Table 1). Fewer participants were meeting the recommendation during

their freshman year of college than were meeting it during their senior year of high school ($\chi^2=7.20$ [1], $p=0.007$).

Physical Activity Patterns

Participation in physical activity changed significantly over the six semesters ($F=12.92$ [5, 340], $p<0.0001$). Post hoc testing revealed that total MET hours per week remained fairly consistent through the senior year of high school ($p=0.83$), significantly declined during the summer between high school and college ($p=0.009$), and further decreased during the first semester of college ($p=0.017$). During the freshman year of college, total MET hours per week did not change ($p=0.86$) (Figure 1).

The most frequently reported vigorous-intensity activity performed during both years was running, with 62.3% and 56.5% of participants engaged in running activity during their senior year of high school and freshman year of college, respectively. The most frequently reported moderate-intensity activity for both years was weight training, with 30.4% engaged in this activity during their senior year of high school and 33.3% engaged during their freshman year of college. Other frequent activities during the senior year of high school included cheerleading and gymnastics (23.2%), aerobic dance (21.7%), swimming (17.4%), cycling (15.9%), and dance (15.9%). During their freshman year of college, students most often participated in aerobic dance (20.3%), swimming (14.5%), and cycling (14.5%) in addition to running and weight training.

DISCUSSION

Participants' physical activity significantly decreased from high school to college. An examination of physical activity patterns by semester revealed that participants were consistently active throughout their senior year of high school, decreased their physical activity during the summer between high school and college, and suffered further reductions in physical activity at the beginning of their freshman year of college.

The majority of previous studies examining changes in physical activity from high school to college included both male

**Table 1. Participant Physical Activity**

	Senior Year of High School	Freshman Year of College	p
Hours per Week*			
Moderate physical activity	3.34 (4.21)	1.14 (1.76)	<0.0001
Vigorous physical activity	2.48 (2.90)	1.65 (1.55)	0.006
Moderate-to-vigorous physical activity	5.82 (5.00)	2.79 (2.42)	<0.0001
MET Hours per Week*			
Moderate-to-vigorous Physical activity	31.66 (26.67)	16.92 (14.32)	<0.0001
Meeting Physical Activity Recommendation†			
Yes	57 (82.6)	45 (65.2)	
No	12 (17.4)	24 (34.8)	0.007
*mean (standard deviation)			
†count (%)			

and female students, used cross-sectional research designs, and focused on vigorous physical activity. Bray and Born¹² conducted a descriptive study to assess physical activity changes from high school to college. In their 9th week of college, freshman students (n=145) were asked to recall their weekly frequency and duration of vigorous activity during their last 8 weeks of high school and first 8 weeks of college. The researchers reported significant declines in activity frequency and in the percentage of students who reported they were sufficiently vigorously active, from 66.2% during the last 2 months of high school to 44.1% during the first 2 months of college. In another study, Leighton and Swerissen¹³ surveyed 195 freshman college students about their perceived change in vigorous physical activity from high school to college. The researchers found that 42% of college students perceived that their activity levels had declined.

The current study used a prospective, longitudinal design and a past-year recall instrument to obtain detailed information regarding participants' moderate and vigorous physical activity during their senior year of high school and freshman year of college. Similar to a previous study,¹² we found significant decreases in physical activity from high school to college.

Baranowski et al.²³ examined physical activity changes during the transition out

of high school in a large sample of adolescents (n=5,881). Using a cross-sectional design and a 7-day recall to assess leisure-time physical activity, they reported a steep decrease in physical activity at the point of transition out of high school. Although the participants in their study were not necessarily college-bound, the step-wise decrease in physical activity during the transition summer from high school to college found in the present study is similar to the pattern reported by Baranowski et al.

Why does physical activity decrease during this transition period? Entering college is a major life transition that involves greater independence and a loss of structure in daily routine. Demands such as managing time among academic, social, and employment responsibilities may impact whether a student chooses to engage in physical activity or other healthy behaviors during this transition. Gyuresik, Bray, and Brittain²⁴ found that females identified several barriers to being vigorously active within the first two weeks of their freshman year of college, including social invitations during preferred exercise times and high academic workloads.

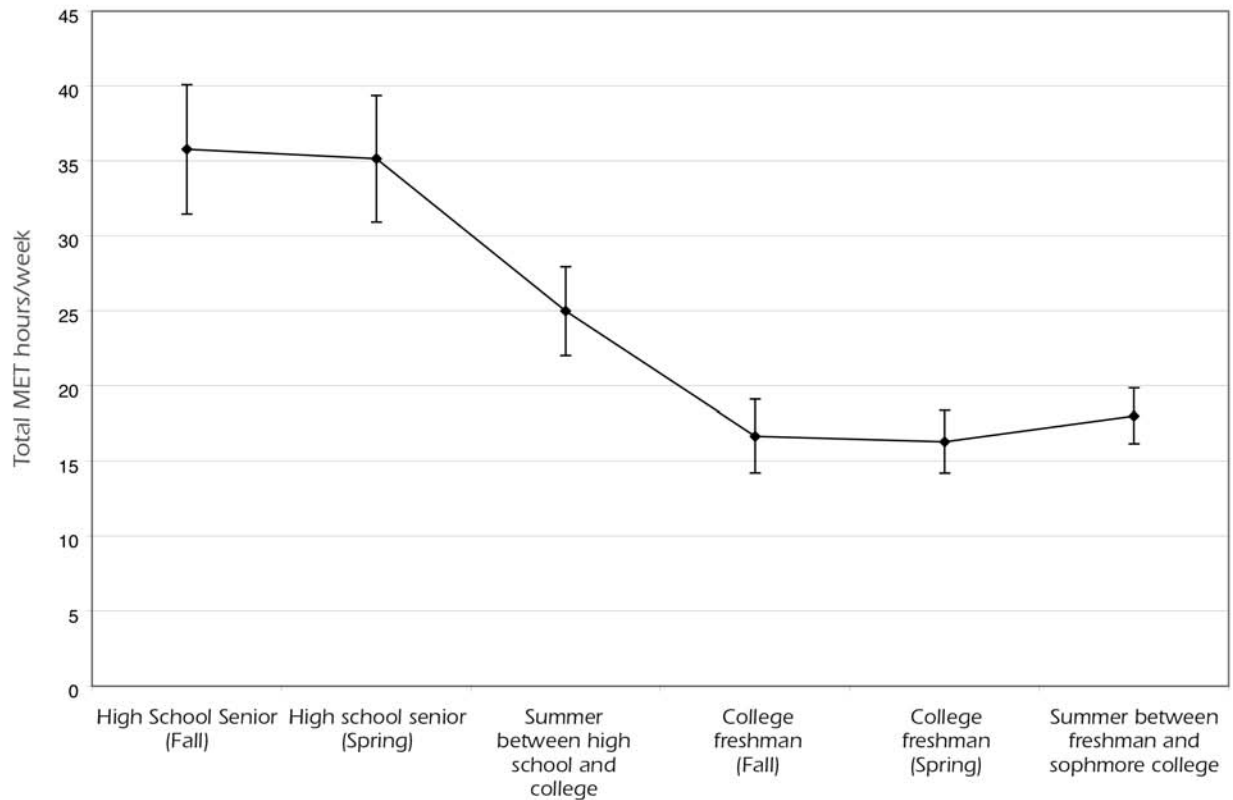
The patterns of physical activity observed in this study differ from those observed in studies of other adult populations in at least one respect. These other studies have found that participation in physical activity varies

by season, with adults being most active during the summer months.²⁵⁻²⁷ Although the present study examined physical activity patterns by semester and not season, we found that activity significantly decreased during the summer between high school and college, but remained fairly consistent over the freshman academic year and during the summer between the freshman and sophomore year of college. While preliminary, these results suggest that additional factors other than season may impact physical activity among female students during the transition from high school to college.

Strengths of this study include the prospective, longitudinal design, and collection of detailed physical activity data. However, the results of this study should be carefully interpreted due to limitations. First, the participants were volunteers, and selection bias may have occurred. Second, the sample was highly physically active at the beginning of the study, and although physical activity significantly decreased from high school to college, approximately 65% of our participants were meeting the current physical activity recommendation during their freshman year of college compared to just 35% of 18-24 year old females in a national study.⁹ Third, while the sample was racially representative of the university freshman female population, 84% of participants were Caucasian. Fourth, we used



Figure 1. Participant Physical Activity By Semester



Note: Mean values and standard errors

a past-year recall instrument to determine physical activity during the senior year of high school and freshman year of college. Although researchers have suggested that estimates of habitual physical activity may be more accurate when collected over a longer period of time,²⁸ it is possible that participants may have experienced difficulty accurately recalling all of their physical activity during the previous 12 months. Fifth, our retention rate was low (42%), although consistent with a previous longitudinal study of college students (38%).¹⁸

TRANSLATION TO HEALTH EDUCATION PRACTICE

Although additional research is needed, health education and promotion professionals should note that the transition from high school to college is a critical time to promote

physical activity among women, even among those who are physically active. Based on this study's findings, we can offer several suggestions to such professionals. Those employed in high school settings should consider developing lifestyle physical activity programs that target females who are college bound. At the college level, professionals could partner with the admissions office to conduct an awareness campaign that provides physical activity information in the orientation materials sent to incoming students during the summer between high school and college. College health education and promotion professionals can also partner with student services personnel during on-campus orientation sessions at the beginning of the academic year to inform freshman females of physical activity opportunities. Finally, health education and promotion profes-

sionals should work with campus officials to develop an environment that supports physical activity—for example, by closing the campus to vehicular traffic during the day, adding sidewalks where needed, and building walking and bicycle pathways.

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