International Journal of EXERCISE SCIENCE

Original Research

Changes in Health Behaviors and Outcomes following Graduation from Higher Education

OLIVER W. A. WILSON†, PETER J. MATTHEWS*, MICHELE DUFFEY‡, ZACK PAPALIA†, and MELISSA BOPP‡[1]

Department of Kinesiology, Pennsylvania State University, University Park, PA, USA

*Denotes undergraduate student author, †Denotes graduate student author, ‡Denotes professional author

ABSTRACT

International Journal of Exercise Science 13(5): 131-139, 2020. The purpose of this study was to examine changes in health behaviors and outcomes of higher education (college) students following graduation. Undergraduate students (n = 206) enrolled at a large, northeastern United States university in general education health and wellness courses were assessed pre and post-graduation. Participants self-reported their demographics, physical activity behaviors, dietary behaviors, sleep, and stress pre and post-graduation via an online survey. Paired sample t-tests examined changes health behaviors pre and post-graduation. Following graduation, fruit and vegetable consumption increased significantly, moderate physical activity declined significantly, and both vigorous physical activity and energy expenditure, as well as weight remained stable. There was a significant reduction in stress, for men but not women, and, an increase in restful nights of sleep among women but not men. College students tended to maintain the seemingly healthy lifestyles they had as students during the period immediately following graduation. Findings highlight the value of general health and wellness courses within college given vigorous physical activity and energy expenditure did not decline following graduation.

KEY WORDS**:** Young adult, college, nutrition, physical activity, exercise, diet, stress

INTRODUCTION

The prevalence of overweight and obesity, insufficient physical activity, poor quality diet, and mental health issues are increasing among higher education students (2, 4). This leaves many graduates at risk of both short and long-term health issues such as increased risk of non-communicable diseases (6, 21, 25), mental health disorders (16, 22, 27), poor quality of life (20, 29), and mortality (21, 38, 44). Thus, identifying ways students can maintain or develop healthy lifestyles during higher education that they can continue, and perhaps even improve, upon graduation holds immense value to individuals, institutions, and society.

Nearly a century ago physical activity was a general education requirement at almost all higher education institutions (23), but has since fallen to less than half (9), and is at risk of continuing to decline. While changes vary considerably between states, daily physical education among

high school students in the United States (US) also declined during the early 1990's and has not recovered (11); and, less than 5% of K12 schools require daily physical education (13) despite the link between physical education and physical activity in adulthood (28). Erosion of physical education opportunities is concerning given the aforementioned trends in health behaviors and outcomes among higher education students (12) and the prevalence of childhood obesity (10).

While not temporally linked with physical activity (41), like physical activity, fruit and vegetable consumption (FVC) tends to decline over the course of college (34), and can impact weight, which is determined by energy intake and expenditure (30). In addition, FVC is associated with lower risk of non-communicable diseases (37, 43) and mortality (26). Furthermore, living situation appears to influence both physical activity and dietary behaviors (34), For example, while at college, those students who live off campus are more likely to be active travelers (i.e. walk of bike for transportation) (7, 32). With respect to diet, the changes in weight among students have been linked with proximity to dining halls and grocery stores, with those close to dining halls tending to gain more weight, and those living close to a grocery store gaining less weight (19). In addition, dietary behaviors have been shown to differ between students who do and do not reside in their parental home (14). Thus, given living situation is likely to change following graduation it is important to examine changes in health behaviors that may be influenced by such a change.

However, at present little is known about how these behaviors change in the period immediately following graduation from college. Thus, the purpose of this study was to examine whether health behaviors and outcomes of higher education students improve, deteriorate, or remain stable following graduation. Such knowledge is important, as there is an opportunity to reach the considerable portion of the population who pursue a higher education (18) during a critical stage in life. Evidence that health behaviors are maintained following graduation will further reinforce the importance of facilitating the adoption of these behaviors among college students to their short and long-term health and well-being.

METHODS

Participants

This longitudinal study took place at a large, northeastern United States university. Data were collected on health behaviors and basic demographics using an online survey (Qualtrics, Provo, UT). Undergraduate students enrolled in general education health and wellness courses between Fall 2014 and Spring 2017 were recruited via direct email. All students enrolled during this period were eligible. Participants completed a baseline survey at the beginning of the semester in which they were enrolled in a general education health and wellness course, and follow-up surveys at the end of the same semester as well as the end subsequent semesters at regular intervals after completion of the course (in April and September). Participants were included if they provided a complete response to follow-up surveys (either April or September) immediately prior to (pre-graduation) and following (post-graduation) graduation. The period of time between pre and post-graduation data collection was approximately six months. Instructors encouraged participation, though participation was voluntary and had no impact on

grades. Participants provided informed consent, the Pennsylvania State University Institutional Review Board approved this study, and research was carried out fully in accordance to the ethical standards of the International Journal of Exercise Science (24).

Protocol

Demographics - Participants self-reported age, sex, race/ethnicity, and other demographic variables at baseline. From the third survey onwards participants self-reported (yes/no) whether they had experienced a range of important life events, such as graduating college, in the past six months. Participants self-reported height at baseline, and weight in baseline and subsequent surveys. Height and weight were used to calculate body mass index.

Physical activity behaviors - The global physical activity questionnaire, a reliable and valid measure (8, 17), assessed minutes/week of leisure time physical activity (5). Weekly moderate physical activity and vigorous physical activity were computed using physical activity frequency and duration, and participants were categorized based on whether they met physical activity recommendations (1). Weekly metabolic equivalent minutes (weekly MET-minutes) were also calculated, with four and eight metabolic equivalents assigned to each minute of moderate and vigorous physical activity respectively (39).

Dietary behaviors - Items from the National College Health Assessment (NCHA, 3) were used to assess fruit, vegetable, and alcohol consumption. Participants indicated how many servings of fruit and vegetables (separately) they consume per day on a seven-point scale ranging from zero to six or more servings and were categorized based on whether they met FVC recommendations (36), and into alcohol users and non-users.

Sleep and stress - Sleep and stress were measured using items from the NCHA (3). Participants indicated how many days they got enough sleep to feel well rested in the morning during the past week and rated their overall stress levels on a five-point scale ranging from no stress to extreme stress. Participants were categorized into those who reported below average, average, or above average stress in response to the NCHA item.

Statistical Analyses

Sex differences pre and post-graduation were examined using independent samples t-tests. Changes in anthropometrics, physical activity, FVC, stress, and sleep were examined using paired sample t-tests. Changes in health behaviors and outcomes based on whether participants were categorized as meeting moderate physical activity, vigorous physical activity, FVC recommendations or displaying symptoms of stress pre and post-graduation were examined using Chi-square tests for independence. All analyses were run using SPSS 25.0 (IBM, Armonk, NY), with significance levels set at $p < 0.05$. Effect sizes (η^2) were calculated using the formula $(t^2 / (t^2 + (N - 1))$.

RESULTS

Two hundred and six participants remained after excluding those who did not indicate that they had graduated. Data collected at the time point prior to that at which participants indicated they had graduated were treated as 'pre-graduation', and data collected at the time point at which the indicated they had graduated were treated as 'post-graduation'.

The mean age of participants at baseline was 20±3 years. The majority of participants were women (women, n = 122, 60.7%; men, n = 79, 39.3%), identified as non-Hispanic white (n = 166, 83.0%), and were enrolled in physical activity courses (physical activity courses, n = 185, 92.5%; general health courses, n = 15, 7.5%). Characteristics of the sample on which analyses were conducted were representative of the baseline sample.

Excluding weight, which would be expected to differ between sexes, independent samples t-tests revealed that no variables differed between sexes, with the exception of post-graduation stress symptoms, which were significantly higher among women (p = 0.005, η^2 = 0.04).

Following graduation weight, and therefore BMI, remained unchanged. A significant decline in moderate physical activity was observed (p = 0.001), in particular among men (p = 0.002). However, vigorous physical activity remained stable, and therefore no changes were observed in energy expenditure (i.e weekly MET-minutes). There was a significant increase in FVC (p = 0.03), which was largely attributable to increased fruit consumption (p = 0.02). However, changes were not statistically significant in men, and the statistical significance of the change observed in analysis of all participants was attributable to women. There was a significant reduction in stress (p = 0.01), in particular for men (p = 0.04); and, a notable increase in the number of restful nights of sleep among women (p = 0.07), but not men (p = 0.95) (Table 1).

Table 1. Changes in health behaviors and outcomes post-graduation.

	Pre-graduation		Post-graduation		p	η^2
	M	SD	M	SD		
All						
Weight (lb)	153.5	31.6	153.5	31.3	0.992	0.00
BMI (kg/m^2)	23.8	4.4	23.9	4.3	0.539	0.00
Moderate physical activity (min/week)*	178.1	162.6	128.3	146.9	0.002	0.06
Vigorous physical activity (min/week)	128.2	131.3	133.0	130.9	0.627	0.00
Weekly MET-minutes	1751.2	1385.5	1584.2	1350.0	0.135	0.01
Fruit consumption (servings/day)*	2.9	1.1	3.1	1.1	0.021	0.03
Vegetable consumption (servings/day)	3.2	1.2	3.3	1.3	0.196	0.01
Fruit and vegetable consumption (servings/day)*	6.1	2.0	6.4	2.1	0.035	0.03
Stress*	3.4	0.9	3.1	0.8	0.011	0.04
Sleep (nights of restful sleep/week)	3.6	1.6	3.9	1.9	0.112	0.02
Men						
Weight (lb)	165.4	31.5	165.9	32.4	0.732	0.00
BMI (kg/m^2)	23.5	4.6	23.6	4.7	0.729	0.00
Moderate physical activity (min/week)*	174.7	130.6	102.6	112.4	0.001	0.18
Vigorous physical activity (min/week)	138.8	138.2	138.7	134.3	0.996	0.00
Weekly MET-minutes	1809.2	1383.8	1520.1	1274.4	0.088	0.05
Fruit consumption (servings/day)	2.9	1.2	2.9	1.0	0.641	0.00

Vegetable consumption (servings/day)	3.0	1.2	3.2	1.3	0.285	0.02
Fruit and vegetable consumption (servings/day)	5.8	2.2	6.1	2.0	0.362	0.01
Stress*	3.3	0.9	3.0	0.8	0.048	0.06
Sleep (nights of restful sleep/week)	3.4	1.6	3.4	1.9	0.954	0.00
Women						
Weight (lb)	145.39	29.82	145.75	28.52	0.643	0.00
BMI (kg/m^2)	23.98	4.22	24.04	4.00	0.603	0.00
Moderate physical activity (min/week)*	186.60	180.55	138.28	153.79	0.029	0.05
Vigorous physical activity (min/week)	121.32	126.75	127.64	128.47	0.587	0.00
Weekly MET-minutes	1739.05	1392.22	1586.77	1352.25	0.293	0.01
Fruit consumption (servings/day)*	2.84	1.06	3.11	1.21	0.018	0.05
Vegetable consumption (servings/day)	3.34	1.22	3.41	1.24	0.527	0.00
Fruit and vegetable consumption (servings/day)	6.18	1.95	6.52	2.16	0.075	0.03
Stress	3.39	0.81	3.24	0.73	0.112	0.03
Sleep (nights of restful sleep/week)	3.75	1.67	4.11	1.75	0.071	0.03

* denotes significance between pre and post-graduation

No differences were found based on meeting moderate physical activity recommendations, χ^2 (1, 168) = 1.59, p = 0.207, Φ = 0.110. Those who did and did not meet vigorous physical activity recommendations pre-graduation remained sufficiently active and insufficiently active respectively post-graduation, χ^2 (1, 168) = 15.06, p < 0.001, Φ = 0.312. Those who did and did not meet FVC recommendations pre-graduation continued to consume sufficient and insufficient fruit and vegetables respectively post-graduation, χ^2 (1, 166) = 15.43, p < .001, Φ = 0.323. Alcohol consumption increased significantly post-graduation among both those who did and did not consume alcohol pre-graduation, χ^2 (1, 166) = 26.77, p < .001, Φ = 0.436. No significant differences were found in pre and post-graduation stress, χ^2 (4, 160) = 4.29, p = .0328, Φ_c = 0.164.

DISCUSSION

Students, consistent with previous findings (35), for the most part, maintained the seemingly healthy lifestyles adopted students despite likely experiencing changes to various aspects of their lives. Changes in moderate physical activity may be attributable to a decline in active travel students typically accumulate navigating a pedestrian- and cyclist-friendly large-campus, while the stability of vigorous physical activity may be indicative of students having established a lifestyle that they maintain during the period immediately following graduation. Findings are somewhat concerning as they arguably represent the best-case scenario with respect to changes in physical activity following graduation. Unlike students with an established active lifestyle, those with less engrained physical activity habits may experience even greater declines. Future researchers may want to consider using objective physical activity measures given the limitations of self-reported measures (31).

Changes in FVC are encouraging, despite them being largely as a result of increased fruit consumption among women. Such changes could potentially be explained by increased accessibility as a result of increased disposable income, or students returning to reside in their parental home (14). Changes could also be attributable to increased accessibility to more personal cooking facilities given findings that suggest shared living situations are associated with lower FVC, potentially due to interpersonal constraints (34). Examination of the

consumption of other food groups would provide further insight into changes graduate's in dietary characteristics.

The apparent improvement in dietary quality (15) may have helped offset the weight increase observed in previous studies (35), though a longer period of energy surplus may be necessary for significant weight changes. Findings suggest an improvement in stress upon graduation, perhaps due to the alleviation of academic and extracurricular stressors. However, the stress item used in this study was very limited, thus this finding requires further investigation. Future researchers should consider using better measures to assess stress, as well as other mental health outcomes such as depression. Finally, sleep improved upon graduation, perhaps due to a shift towards a more stable routine that disrupted less by academic and social commitments.

A relatively small sample size was the primary limitation of this study that prevented analyses of differences based upon what graduates had moved on to do since graduation, e.g. graduate study, full-time work, part-time work, travel, etc. Identifying ways to retain graduates in similar studies would be of great value. Also, the relatively active nature of the sample limits generalizability to the general student population. Moreover, the use of self-reported measures, in particular for physical activity weight, and BMI (33, 40), mean that findings should be interpreted with a degree of caution. Future researchers may want to consider more objective measures, as well as more comprehensive measures that assess more dietary and physical activity behaviors in more detail (34, 41, 42). In addition, comparison in changes in health outcomes and behaviors between those who do and do not take general health and wellness would clarity the potential value of such courses in the promotion of a healthy lifestyle.

In conclusion, this study provides insights into the changes in health behaviors and outcomes following graduation from higher education. Findings suggest the restfulness of sleep and stress levels tend to improve post-graduation, as does FVC. More importantly, that vigorous physical activity and energy expenditure did not decline following graduation suggests that general health and wellness, in particular physical education, courses within higher education are valuable to student health and wellbeing beyond graduation. Thus, higher education institutions should consider ways in which they can increase the quantity, quality, and breadth of general health and wellness opportunities in order to equip students with skills necessary maintain a healthy lifestyle and contribute to society.

REFERENCES

1. 2018 Physical Activity Guidelines Advisory Committee. 2018 physical activity guidelines advisory committee scientific report. Washington, DC: U.S. Department of Health and Human Services; 2018.

2. American College Health Association. American college health association-national college health assessment ii: Reference group executive summary Fall 2008; 2009.

3. American College Health Association. About american college health association-national college health assessment: Survey; 2018.

4. American College Health Association. American college health association-national college health assessment ii: Reference group executive summary Spring 2018; 2018.

5. Armstrong T, Bull F. Development of the world health organization global physical activity questionnaire (GPAQ). J Public Health 14(12): 66-70, 2006.

6. Bhupathiraju SN, Wedick NM, Pan A, et al. Quantity and variety in fruit and vegetable intake and risk of coronary heart disease. Am J Clin Nutr 98: 1514-1523, 2013.

7. Bopp M, Bopp C, Schuchert M. Active transportation to and on campus is associated with objectively measured fitness outcomes among college students. J Phys Act Health 12(3): 418-423, 2015.

8. Bull F, Maslin TS, Armstrong T. Global physical activity questionnaire (GPAQ): Nine country reliability and validity study. J Phys Act Health 6: 790-804, 2009.

9. Cardinal BJ, Sorensen SD, Cardinal MK. Historical perspective and current status of the physical education graduation requirement at american 4-year colleges and universities. Res Q Exerc Sport 83(4): 503-512, 2012.

10. Centers for Disease Control and Prevention. Results from the school health policies and practices study 2014. In: 2014. https://www.cdc.gov/healthyyouth/data/shpps/pdf/shpps-508-final_101315.pdf.

11. Centers for Disease Control and Prevention. Nutrition, physical activity, and obesity: Data, trends and maps. In: 2015. https://www.cdc.gov/nccdphp/dnpao/data-trends-maps/index.html.

12. Centers for Disease Control and Prevention. Childhood obesity facts. In: 2017. https://www.cdc.gov/obesity/data/childhood.html.

13. Centers for Disease Control and Prevention. High school Youth Risk Behavior Surveillance System. In: 2018. https://nccd.cdc.gov/youthonline/App/Default.aspx.

14. El Ansari W, Stock C, Mikolajczyk RT. Relationships between food consumption and living arrangements among university students in four european countries - a cross-sectional study. Nutr J 11(1): 28, 2012.

15. El-Kassas G, Ziade F. Exploration of the dietary and lifestyle behaviors and weight status and their self-perceptions among health sciences university students in north Lebanon. BioMed Res Int 2016: 14, 2016.

16. Gariepy G, Nitka D, Schmitz N. The association between obesity and anxiety disorders in the population: A systematic review and meta-analysis. Int J Obes 34: 407-419, 2010.

17. Herrmann SD, Heumann KJ, Der Ananian CA, Ainsworth BE. Validity and reliability of the global physical activity questionnaire. Meas Phys Educ Exerc Sci 17(3): 221-235, 2013.

18. Institute for Education Sciences. Enrollment and employees in postsecondary institutions, fall 2015; and financial statistics and academic libraries, fiscal year 2015. In: National Centre for Educational Statistics editor. US Department of Education: Institute for Education Sciences; 2017.

19. Kapinos KA, Yakusheva O, Eisenberg D. Obesogenic environmental influences on young adults: Evidence from college dormitory assignments. Econ Hum Biol 12: 98-109, 2014.

20. Kushner RF, Foster GD. Obesity and quality of life. Nutrition 16(10): 947-952, 2000.

21. Lee IM, Shiroma EJ, Lobelo F, et al. Effect of physical inactivity on major non-communicable diseases worldwide: An analysis of burden of disease and life expectancy. Lancet 380(9838): 219-229, 2012.

22. Luppino FS, de Wit LM, Bouvy PF, et al. Overweight, obesity, and depression: A systematic review and meta-analysis of longitudinal studies. Arch General Psychiat 67(3): 220-229, 2010.

23. McCristal KJ, Miller EA. A brief survey of the preset status of the health and physical education requirements for men students in colleges and universities. Res Q 10(4): 70-80ii, 1939.

24. Navalta JW, Stone WJ, Lyons TS. Ethical issues relating to scientific discovery in exercise science. Int J Exerc Sci 12(1): 1-8, 2019.

25. Ness AR, Powles JW. Fruit and vegetables, and cardiovascular disease: A review. Int J Epidemiol 26(1):1-13, 1997.

26. Nguyen B, Bauman A, Gale J, et al. Fruit and vegetable consumption and all-cause mortality: Evidence from a large australian cohort study. Int J Behav Nutr Phys Act 13(1): 9, 2016.

27. Paluska SA, Schwenk TL. Physical activity and mental health. Sports Med 29(3): 167-180, 2000.

28. Physical Activity Council. The physical activity council's annual study tracking sports, fitness, and recreation participation in the US. 2018.

29. Pucci GC, Rech CR, Fermino RC, Reis RS. Association between physical activity and quality of life in adults. Rev Saude Publica 46(1): 166-179, 2012.

30. Romieu I, Willett WC, Stampfer MJ, et al. Energy intake and other determinants of relative weight. Am J Clin Nutr 47(3): 406-412, 1988.

31. Sallis JF, Saelens BE. Assessment of physical activity by self-report: Status, limitations, and future directions. Res Q Exerc Sport 71(Suppl. 2): 1-14, 2000.

32. Sims D, Bopp M, Wilson OWA. Examining influences on active travel by sex among college students. J Transp Health 9: 73-82, 2018.

33. Slootmaker SM, Schuit AJ, Chinapaw MJ, Seidell JC, van Mechelen W. Disagreement in physical activity assessed by accelerometer and self-report in subgroups of age, gender, education and weight status. Int J Behav Nutr Phys Act 6(1): 1-10, 2009.

34. Small M, Bailey-Davis L, Morgan N, Maggs J. Changes in eating and physical activity behaviors across seven semesters of college. Health Educ Behav 40(4): 435-441, 2013.

35. Sparling PB, Snow TK. Physical activity patterns in recent college alumni. Res Q Exerc Sport 73(2): 200-205, 2002.

36. United States Department of Health and Human Services, United States Department of Agriculture. 2015–2020 dietary guidelines for Americans. In: 2015. http://health.gov/dietaryguidelines/2015/guidelines/.

37. Wang P-Y, Fang J-C, Gao Z-H, Zhang C, Xie S-Y. Higher intake of fruits, vegetables or their fiber reduces the risk of type 2 diabetes: A meta-analysis. Journal of Diabetes Investigation 7(1): 56-69, 2016.

38. Wang X, Ouyang Y, Liu J, et al. Fruit and vegetable consumption and mortality from all causes, cardiovascular disease, and cancer: Systematic review and dose-response meta-analysis of prospective cohort studies. BMJ 349(jul29 3): g4490-g4490, 2014.

39. WHO. Global physical activity questionnaire (GPAQ) analysis guide 2018.

40. Wilson OWA, Bopp CM, Papalia Z, Bopp M. Objective vs self-report assessment of height, weight and body mass index: Relationships with adiposity, aerobic fitness and physical activity. Clin Obes 9(5): e12331, 2019.

41. Wilson OWA, Graupensperger S, Bopp M, Evans MB. The temporal association between physical activity and fruit and vegetable consumption: A longitudinal within- and between-person investigation. J Phys Act Health 16(4): 274-280, 2019.

42. Wilson OWA, Papalia Z, Duffey M, Bopp M. Differences in college students' aerobic physical activity and muscle-strengthening activities based on gender, race, and sexual orientation. Prev Med Rep 16, 2019.

43. Zhan J, Liu Y-J, Cai L-B, et al. Fruit and vegetable consumption and risk of cardiovascular disease: A meta-analysis of prospective cohort studies. Crit Rev Food Sci Nutri 57(8): 1650-1663, 2017.

44. Zimmermann E, Holst C, Sørensen TIA. Lifelong doubling of mortality in men entering adult life as obese. Int J Obes 35(9): 1193-1199, 2011.