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College Physical Activity is Related to Mid-Life Activity Levels in Women

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ABSTRACT

Hultquist CN, Duckham R, Stinson C, and Thompson DL. College Physical Activity is Related to Mid-Life Activity Levels in Women. *JEPonline* 2009;12(4):1-7. It has been suggested, but not clearly established, that physical activity (PA) during the college years is a determinant of long-term PA patterns. The purpose of this study was to examine the relationship between PA during the college years and current PA in college-educated women. Fifty-five college-educated women, aged 39.3 ± 6.5 y, were recruited for this study and were, on average, 14.9 ± 7.4 y post-college. Participant's history of PA during college years and the present time was determined from the Lifetime Physical Activity Questionnaire. A brief demographic questionnaire that addressed current PA patterns was also administered. Results showed a significant correlation between leisure activity (LA) during college years and current LA ($r = 0.424$, $p = 0.001$). There was no difference between median college LA and current LA (22.4 and 27.9 MET hours per week, respectively, $p = 0.129$). However, total college PA reported was significantly lower than total current PA (34.7 and 70.7 MET hours per week, respectively, $p \leq 0.001$), with this difference due to an increase in household activities during mid-life. Marital status, the presence of children under the age of 18 in the home, and employment status had no significant impact on LA for this sample. These data suggest that leisure-time PA patterns practiced during college years may carry over to mid-life.

Key Words: Exercise Patterns, Body Composition.

INTRODUCTION

According to Bandura's social cognitive theory (2), past experiences influence current behavior. Further, this theory suggests that human behavior is a function of the interaction among environmental, behavioral, and cognitive factors where past experiences, referred to as mastery experiences, have a strong influence over behavior (2). It has been postulated that these factors interact to influence a person's sense of self-efficacy (2). Lifelong physical activity (PA) patterns influence health and overall quality of life. Research has shown that physically active individuals reap many health benefits (14, 15), yet the high prevalence of physical inactivity continues to be an on-going challenge for health and fitness professionals (11). The prevalence of sedentary behavior is 25.9% and 21.4% for American women and men, respectively (11).

It has been suggested, but not clearly established that being physically active during the college years is a determinant of long-term PA (19). While many life events may influence PA levels, the college years may be significant because college students are assuming responsibility for many aspects of adult life, including choices about use of leisure time (4). Individuals who were active during the college years tend to remain active in the years immediately following graduation (4, 19). Unfortunately, the examination of the relationship between PA levels in college and PA levels later in life is limited. Studies have generally focused on PA levels shortly after the college years (4, 19). Calfas and colleagues (4) questioned current students and recent alumni (within five years) of an institution and found similar levels of PA for the two groups. A more recent investigation found 84.7% of participants who reported being active during their senior year reported being active in the years immediately following graduation (19). Likewise, over 80% of individuals who were inactive during their senior year reported the same or less activity in the years after graduation (19). This suggests that overall PA patterns continue after graduation, but the mean number of years post-graduation was only six, making it impossible to draw long-term conclusions.

The purpose of this study was to examine the relationship between women's PA during the college years and PA during mid-life. Total physical activity was divided into 2 categories: (1) leisure activity (LA), which is any activity done in one's leisure time, and (2) household activities, which includes cleaning, yard work, and caring for one's family. Additionally, other variables that may influence PA levels for college-educated women during mid-life (marital status, having children under 18 y in the home, employment status, and exercising alone or with a partner) were also investigated.

METHODS

Subjects

Participants were college-educated women between the ages of 30 and 50 years. All procedures were reviewed and approved by the Institutional Review Board at a large university in the southeast U.S. Each subject provided written informed consent prior to participation. Recruitment included university and community postings (local newspapers, religious and civic groups, etc). To limit the influence of confounding factors on PA, potential participants were excluded if they reported pregnancy or orthopedic limitations to PA.

Procedures

Upon inclusion, participants reported for testing following an overnight fast and having abstained from exercise the morning of the test. Body mass and body fat percentage were assessed using the BOD POD body composition system (Life Measurement Inc., Concord, CA). Subjects wore a lycra swimsuit and swim cap and were tested to the manufacturer's specifications. A female-specific equation, assuming a fat-free tissue density of $1.097 \text{ kg} \cdot \text{l}^{-1}$, was used to estimate body fat percentage (8). Standing waist and hip circumference were measured in duplicate using a Gulick fiberglass

measuring tape with a tension handle (Creative Health Products, Inc., Plymouth, MI), and mean values were used in calculations. BMI was calculated by dividing the mass in kilograms by the height in meters squared ($\text{kg}\cdot\text{m}^{-2}$).

Participants' history of PA during college years and current PA was determined from the self-administered Lifetime Physical Activity Questionnaire (LPAQ) (5, 10). This commonly used questionnaire has been found to be a reproducible measure of historical PA (5). To assess PA during the college years, participants identified activities they participated in from age 18 through 21 years. To assess current PA, participants identified activities of the previous 12 months. Two domains of PA resulted from the questionnaire; leisure activity (LA) and household activity. Participants first identified activities and then estimated the number of years, months per year, and hours per week spent in each activity. The average number of hours per week spent in each activity was multiplied by its intensity (1), and PA was reported in average MET hours per week (5).

Participants completed a demographic questionnaire that addressed factors that could impact PA patterns such as marital status, children under the age of 18 years, employment status, and exercising alone or with a partner. For seven days following the laboratory testing, participants wore a sealed NL-2000 pedometer (New Lifestyles Inc., Kansas City, MO) capable of storing seven days of data. To assess if participants were meeting current public health recommendations, a 7-day PA log was kept. Women recorded all PA that occurred during the week including type and time spent in the activity. Participants were classified as active at the minimum recommended level if they reported moderate-intensity activity at least 30 minutes per day, 5 or more days per week, or vigorous-intensity activity at least 20 minutes per day, 3 or more days per week (7).

Statistical Analyses

Statistical analyses were performed using SPSS for Windows version 14.0 (SPSS Inc., Chicago, IL). Spearman correlations were used to determine the relationship between college LA and current LA. Spearman correlations were also used to determine the relationship between current LA and body composition variables. Stepwise regression was used to determine which combination of factors were most closely related to current LA. Wilcoxon signed ranks test was used to compare college PA and current PA. Chi-square analyses were used to determine relationships between categorical variables. Significance level was set at $p < 0.05$ for all tests.

RESULTS

The average age of the 55 participants was 39.3 ± 6.5 y and they were, on average, 14.9 ± 7.4 y post-college. Given that the average life span of females in the U.S. is approximately 81 y, we are

comfortable characterizing these subjects as mid-life women. Thirty-nine women were married (70.9%), 27 had children under the age of 18 in the home (49.1%), and 41 were employed full-time (74.5%). Table 1 lists the physical characteristics.

Wilcoxon signed ranks tests revealed no difference between

reported college LA and current LA (22.4 and 27.9 MET hours per week, respectively, $p = 0.129$). However, total college PA was significantly lower than total current PA (34.7 and 70.7 MET hours per

Table 1. Subject characteristics.

Variable	Mean \pm SD	Minimum	Maximum
Age (y)	39.3 \pm 6.5	30	50
Height (cm)	164.9 \pm 5.7	150.0	178.0
Body mass (kg)	63.6 \pm 13.5	49.9	140.5
BMI ($\text{kg}\cdot\text{m}^{-2}$)	23.2 \pm 4.4	17.3	45.5
Body fat (%)	28.6 \pm 9.2	10.4	56.3
Waist circumference (cm)	73.2 \pm 12.4	58.3	144.3
Hip circumference (cm)	98.9 \pm 11.4	87.2	147.8
Average steps/day	9483 \pm 2511	4033	14381

week, respectively, $p \leq 0.001$), with this difference due to an increase in household activities (Table 2).

A significant correlation was found between college LA and current LA ($r = 0.424$, $p = 0.001$). There was a significant correlation between current LA and body mass ($r = -0.408$, $p = 0.002$), BMI ($r = -0.303$, $p = 0.025$), body fat percentage ($r = -0.331$, $p = 0.014$), waist circumference ($r = -0.420$, $p = 0.001$), and hip circumference ($r = -0.370$, $p = 0.010$).

Stepwise linear regression revealed that college LA and choosing to exercise alone or with a partner were most predictive of current LA ($R^2 = 0.320$, $p < 0.001$). With these factors in the model, the addition of marital status, employment status, and children under age 18 years did not significantly improve the R^2 .

Table 2. Median MET hours per week.

Activity	Current Year MET hours per week (interquartile range)	College Years MET hours per week (interquartile range)
Total	70.7* (44.8-116.6)	34.7 (15.7-61.6)
Leisure	27.9 (17.1-48.1)	22.4 (6.0-45.5)
Household	31.8* (9.1-78.7)	5.5 (2.3-12.1)

*Significantly different than college years

Chi-square analyses revealed that those above the median in current LA were more likely to participate in group exercise classes ($\chi^2 = 4.231$, $p = 0.04$) and meet current PA recommendations ($\chi^2 = 5.684$, $p = 0.017$). Those who met current PA recommendations generally averaged over 10,000 steps/day ($\chi^2 = 6.939$, $p = 0.008$) and had a BMI $< 25.0 \text{ kg}\cdot\text{m}^{-2}$ ($\chi^2 = 6.097$, $p = 0.014$). Marital status, the presence of children under the age of 18 in the home, and employment status had no significant impact on LA for this sample.

DISCUSSION

Few studies have examined the relationship between college PA and PA later in life. While most studies examining this issue have focused on short-term relationships (4, 19), this study is unique in its examination of college-educated women approximately 15 y post-college. This study demonstrates that college LA is related to mid-life LA in women. Similar to these findings, others have shown that college activity is related to PA shortly after graduation (4, 19). Additionally, required college physical education classes may increase participation in post-college PA, at least in the short-term (18).

Social support is generally positively associated with exercise behavior, particularly for women (6, 17, 20). Participation in group exercise classes was significantly related to having higher levels of LA in this sample, suggesting that exposure to a group environment may positively influence a woman's choice to engage in routine PA. Additionally, multiple regression revealed that adding information about whether women choose to exercise alone or with a partner significantly improved the prediction model. Thus, this study provides additional evidence that exercise behavior in women is positively impacted by social support.

Although the focus of this paper is LA, the PA questionnaire also captured household PA. The higher total current PA compared to college PA was because of an increase in household activities, which speaks to the additional responsibilities faced by many people. Because of household responsibilities, individuals must accommodate for the time needed to carry out household chores in addition to career requirements and leisure activities. Given that these women had similar LA patterns from college into mid-life, that 74.5% of the women were employed full-time, and nearly one-half had

children under the age of 18 years, the LA habits that existed during the college years have persisted despite increased demands on their time. These findings are in contrast to Brown and Trost (3), who found that young women (early 20's) who reported getting married, having children, or starting a career were more likely to become inactive following these events. The ages of subjects may be partially responsible for the difference in results. Another reason for the difference between studies may be socio-economic status (SES) as only 43.7% of Brown and Trost's (3) women were college-educated; an important indicator of SES. Recent data revealed that regardless of race or ethnicity, lower SES was related to higher prevalence of physical inactivity in women (16).

In this study, the use of a pedometer provided an objective measure of daily ambulation. The PA log captured all reported exercise for seven consecutive days, and allowed determination of whether or not women met recommended levels of PA (7). Similar to other research, women from this sample who met current public health recommendations for PA averaged over 10,000 steps per day (13). A rather high percentage of women in this study met current PA recommendations. Approximately 47% of U.S. adult women participate in recommended levels of PA, and more specifically, approximately 50% of non-Hispanic white women meet current recommendations (12). Approximately 70% of the women in this investigation met recommended PA levels and those who did not meet recommendations were not completely inactive. This may be due to more active women volunteering to participate in research about PA patterns. Also, because all participants had a post-secondary education, one would expect higher than average activity levels. While the reason for this phenomenon remains unknown, recent data revealed that higher levels of education are associated with a higher prevalence of PA for both men and women (12). Additionally, the median MET hours per week of women in the current study were similar to those found by Chasen-Taber and colleagues in a study examining the reproducibility of the LPAQ in college-educated mid-life women (5). Thus, finding our sample to be more active than the U.S. average is not surprising.

While the correlation was moderate between body composition variables and current LA, these relationships were significant and consistent with other studies reporting a link between activity levels and body composition in women (9, 21). This provides additional evidence that, for mid-life women, routine PA makes an important contribution to energy balance and assists with weight control.

Some limitations of this study include the assessment of a rather homogenous sample of college-educated women. Therefore results may not be applicable to other populations. Another limitation was that historical PA was determined through participant recall and an over or under-estimation of PA could have occurred. Without following subjects for substantial periods of time, this limitation is unavoidable. Additionally, choosing to use a previously designed survey to quantify college PA limits our ability to fully characterize the PA patterns of the women when they were in college. Thus we do not have information on things such as whether or not they were athletes, how they commuted to and on campus, and whether or not they participated in activities such as intramurals.

CONCLUSIONS

With evidence that LA during the college years is related to LA during mid-life for female college graduates, it is important to consider how mastery experiences during college might influence physical activity choices later in life. College programs in which students are exposed to and encouraged to live an active lifestyle may yield long-term benefits. In particular, programs that emphasize a supportive social atmosphere may yield greater participation. Additional studies clarifying factors, past and present, which influence exercise behavior in adult women, are needed. The identification of factors that influence long-term exercise adherence need to be continually

examined so that health and fitness professionals can design effective and motivating programs that influence exercise behavior, not only for young adults, but throughout the lifespan.

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