

ASSOCIATIONS BETWEEN FREQUENT SOCIAL MEDIA USAGE AND MARKERS OF AEROBIC FITNESS IN COLLEGE AGED STUDENTS

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Abstract

Aim: Social media leisure time activities have become a very popular activity in Worldwide, and with an increase in social media use research has shown a similar decline in physical participation and a decrease in aerobic capacity. Decreases in physical activity time have been positively associated with an increase for all-cause mortality and the increased risk development for obesity and cardiovascular disease conditions. **Methods:** A sample of the Northern Illinois student body (n = 161) was examined for associations between social media time on markers of aerobic fitness capacity and daily physical activity. Institution Review Board consent was given, and subjects then were asked to complete a 7-day recall to assess their social media usage, which was interview administered, had a bioimpedance analysis scan, completed a PACER aerobic fitness test, and wore a pedometer for seven days to assess steps per day. **Results:** Subjects were classified depending on their social media time usage as infrequent users, moderate users, and frequent users by percentile ranks. PACER scores were reduced in the frequent users compared to the infrequent users and this was statistically significant (p = .027). Steps per day exhibited similar trends with a decreased step count per day for the frequent users compared to the infrequent users (p = .023). **Conclusions:** College students who engage in a greater volume of social media use per day displayed a greater decrease in aerobic fitness as assessed by the PACER test and exhibited a greater decline in physical activity quantified by steps taken per day.

Keywords: Physical fitness, aerobic capacity, social media, PACER

Introduction

College students have many challenges to face when beginning a new chapter in life. With a new school environment, college students must make personal decisions and choices that were in the past made for them such as nutritional decisions, physical activity time, and leisure time activities of their enjoyment. One of the most important decisions new college students need to address is how to include daily physical activity, such as walking or participating in planned exercise while balancing schoolwork, personal agendas, and employment. Evidence has shown that sedentary time among college students has increased over the past decade, and that college students engage in higher levels of sedentary time compared to the general young adult population (Castro et al. 2020; Moulin et al., 2021). Resting energy expenditure corresponding to one metabolic equivalent (MET) is considered sedentary. Examples of sedentary behaviors include waking behaviors characterized by an energy expenditure ≤ 1.5 METs, sitting, reclining, or lying posture (Tremblay et al., 2017). With this increased sedentary time, there is usually a

decrease in daily physical activity time and planned exercise. Regular physical activity decreases the risk of cardiovascular disease, diabetes, obesity, anxiety, and depression (Haskell et al., 2007; Anderson & Durstine, 2019; Riegel et al., 2017). Data from longitudinal studies investigating reduced disease risk has shown lifestyle interventions that incorporate daily physical activity and having a high cardiorespiratory fitness are beneficial (Guthold et al., 2018; Guthold et al., 2020). Physical inactivity prevalence is the percentage of individuals who do not perform sufficient daily PA to meet the PA and exercise guidelines of at least 150 min of moderate-intensity aerobic PA per week or at least 75 min of vigorous PA per week for adults (WHO, 2015) and at least 60 min of moderate-to vigorous-intensity daily PA for children aged 5 to 17 (WHO, 2010). It is estimated that 25% of young adults (18-44 years) are classified as inactive (Benjamin et al., 2019) and that an increase in physical inactivity can be associated with changes in technology with an emphasis on an increased screen time usage of mobile devices or computers on platforms classified as social media interaction services.

Social media leisure time activities have drastically increased in the last decade with the introduction of new platforms that allow for online personal contact, video sharing and watching, and allowing for a greater opportunity for leisure time directly at the fingertips of the users. Nearly 90% of young adults ranging from 18-29 years old now use special media – a substantial 78% percent increase from just a little over a decade ago (Perrin et al., 2015). *Social media* can be defined as internet-based applications that facilitate the exchange of messages or user-generated content for the purpose of social connectedness, entertainment, or education (Kaess et al., 2020). In 2021, it is estimated that 4.3 billion people had a social media account and that the average user spend around two and a half hours per day on social media platforms (GWI., 2020). A study by Villanti and colleagues found that young adults on average used 7.6 social media platforms daily, with 85% of them using 6 or more sites regularly (Villanti et al., 2017). There are established associations between internet usage as a leisure time activity leading to an increased sedentary time and an increased risk for obesity in children and adults (Vandelanotte et al., 2009; Sission et al., 2011). The increase in sedentary lifestyle can lead to lower energy expenditure and weight gain, a decline in physical activity time, and a decrease aerobic fitness in students who participate in a greater quantity of social media screen time. This study aimed to examine social media time per day and its associations with aerobic fitness and overall physical activity patterns. The researchers hypothesized that students who engage in frequent social media usage will demonstrate a negative relationship with physical activity time (walking time) and aerobic fitness capacity.

Methods

Participants

Subjects were recruited from the student body population of a midsize university (15,000 students) located in the Midwest region of the United States. For initial inclusion into the study, subjects had to be a current university student, classified as a non-university athlete, and free of cardiovascular disease as assessed by the health history questionnaire (HHQ) and PARQ. Institutional Review Board approval was obtained prior to any data collection and informed consent was collected from all participants after a detailed explanation of the aims, benefits,

and risks involved with this investigation. Data collection occurred in the fall and spring semesters of the academic calendar year.

Screening visit

Following the HHQ and consent, anthropometric measurements were quantified by bioimpedance analysis using the Inbody 520 (Version 520DM-1520; Biospace, Inc., Los Angeles, CA, USA) and a standard stadiometer. Participants remained standing for 15 minutes prior to testing to allow for normal circulation of blood and fluid movement according to the manufacturer's guidelines. Instructions were given to the participants to refrain from consuming a meal two hours prior to arrival, void their bowels, to remain hydrated, and to abstain from moderate to intense exercise for 12-hours before the screening and testing sessions.

Social Media Interaction Time

Subjects completed a recall survey for screen time usage for assessing time spent interacting with social media platforms. Average daily time spent on social media platforms was assessed over the previous 7 days with a self-reported survey that was interviewer administered. Social media platforms examples were Facebook and Instagram or defined as any social media web-based platform where the students engaged with other individuals. This included posting information, responding to other people's posts, watching videos others posted, creating videos for posting, commenting on web posts, or just browsing the social platforms for content.

The time frame was based on wake schedule of 8:00am until 12:00am with a sleep duration of 8 hours which was based on research in young adults showing a mean of 8.2 hours for sleep duration (Meyer et al., 2012). Subjects were asked to provide the amount of time for five weekdays and for two weekend days. Daily average was calculated as $[(\text{weekday total} * 5) + (\text{weekend day total} * 2) / 7]$ and time is reported as average hours per day. Subjects were sub-divided into three groups based on percentile rankings their social media habits defined as: infrequent (0.0 to 3.50 hours), moderate (3.51 to 5.60 hours), or frequent user (< 5.61 hours). Similar studies examining social media time usage on health measures sub-divided groups in three category groups for analysis.

Aerobic fitness and physical activity

Seven days following the screening subjects returned for the physical fitness testing. Instructions were given to the subjects to refrain from consuming food for two hours before testing and to have abstained from moderate/intense physical activity 24 hours prior to the physical fitness testing. The primary investigator administered the adult 20-meter Progressive Aerobic Cardiovascular Endurance Run (PACER) test administered by the primary investigator. The PACER shuttle test is a validated running test to estimate aerobic capacity (Matsuzaka et al., 2004). The shuttle test was conducted in a gymnasium with markers placed 20 meters apart. Participants ran from one marker (A) to another marker (B) set 20 meters apart, while keeping pace with a prerecorded cadence on the PACER recording compact disc. The recording provided a brief instructional tutorial on how to perform the test and questions were

answered by the testing technicians. Subjects continued the test until voluntary exhaustion. When the subject failed to reach the 20-meter marker twice consecutively, the test was terminated. Subjects were encouraged to give maximal effort. Test data recorded was the total lengths of the PACER laps completed before exhaustion.

The subjects wore digital pedometers to measure their daily steps to quantify physical activity. The technicians instructed the participants to place the pedometer at regular waist or belt height, in line with the femur and patellar bone, and to leave it on for the day. The subjects filled out log sheets to record the total steps at the end of each day before retiring to bed. The pedometer's final step count and log sheet's total count were verified.

Statistical Analysis

Results are presented as mean \pm standard deviation. A Shapiro-Wilk's test was performed to assess for normal distribution. A one-way ANOVA, with Tukey post hoc analysis was used to determine differences between groups for body composition, CRF markers, and social media interaction time by usage stratification groups. A Pearson's correlation coefficient test was run to assess the relationship between physical fitness and body composition. The correlations were distributed according to *r* values, which were classified as very weak (0.0-0.2), weak (0.2-0.4), moderate (0.4-0.7), strong (0.7-0.9), and very strong (0.9-1.0). Tukey Post Hoc analysis was performed to determine difference between television viewing time groups. Alpha level was set to $p < 0.05$ for ANOVA and Pearson's rank-order correlation coefficient test. All statistical analyses were performed using SPSS v.24 (IBM Corp., Armonk, New York).

Table 1. Subject baseline demographics by social media interaction groups.

Variables	All Subjects	Infrequent	Moderate	Frequent
Age	22.7 \pm 2.7	23.4 \pm 3.5	22.7 \pm 2.4	21.9 \pm 1.6
Weight (lb.)	167.2 \pm 36.1	168.9 \pm 35.1	162.5 \pm 34.4	170.0 \pm 38.6
Height (in)	66.7 \pm 5.2	67.1 \pm 7.3	66.7 \pm 4.3	66.7 \pm 3.6
Lean body mass (lb.)	126.7 \pm 28.9	134.2 \pm 31.5*	120.1 \pm 27.2	126.5 \pm 26.7
Body fat mass (lb.)	40.4 \pm 22.1	34.7 \pm 19.7	42.6 \pm 22.6	43.6 \pm 24.7
Percent body fat	23.5 \pm 10.2	19.8 \pm 8.9*	24.8 \pm 10.5	24.8 \pm 10.1

Note: Values are mean \pm SD, * = significant at $p < .005$.

Table 2: Social media time per day in hours with Tukey post hoc analysis.

Variables	All Subjects	Infrequent	Moderate	Frequent
n	164	53	57	54
Social media (per day)	4.96 \pm 2.8	2.10 \pm .97* ^A	4.52 \pm .60* ^B	8.22 \pm 2.1* ^C

Values are mean \pm SD, viewing time was recorded as average hours per day, * = significant at $p < .001$,

A was different than B, C, at $p < .001$, B different than A, C, at $p < .001$, C is different than A, B, at $p < .001$ for males and females.

Table 3: ANOVA - Markers of aerobic fitness characteristics by groups based on social media time per day.

Variables	All Subjects	Infrequent	Moderate	Frequent	p value
PACER (# laps)	42.1 ± 19.1	47.6 ± 17.9	40.5 ± 18.5	38.2 ± 19.1*	.027
Steps per Day	7,304.4 ± 3,624	7,965.1 ± 3,260	7,625.9 ± 3,496	6,312.3 ± 2,991*	.023

Note: Values are mean±SD, * significant difference between the frequent group and the infrequent group.

Results

Demographics

One hundred ninety-one Northern Illinois University students were recruited to complete this study and one hundred sixty-four subjects completed all testing required for inclusion. Subjects were not included if they had incomplete data for the analysis. Subjects were divided by tertial percentages based on the median total amount (hours) of social media they engaged in per day, Infrequent usage, Moderate usage, and Frequent usage. All variables were normally distributed as assessed by Shapiro-Wilk's test ($p > .05$) and homogeneity of variance was met for all variables.

There was no statistically significant difference for $p = .397$, weight; $F(2,168) = 1.263$, $p = .285$, height; $F(2,168) = 1.542$, $p = .217$, $p = .741$, or fat mass; $F(2,168) = 1.716$, $p = .183$. A significant difference was observed for the lean body mass $F(2,161) = 3.393$, $p = .036$, post hoc analysis demonstrated a difference between the infrequent and moderate groups ($p = .027$). A significant difference was observed for percent body fat $F(2,161) = 5.484$, $p = .005$, post hoc analysis demonstrated a difference between the infrequent and moderate groups ($p = .001$) and the frequent and infrequent groups ($p = .027$). Table 1 represents the demographic data.

Social media usage time

Data is presented as mean ± standard deviation in table 2. There were no outliers in the data, as assessed by inspection of a boxplot. The social media time increased from the infrequent ($n = 53$, $M = 2.1$, $SD = 0.9$), to moderate ($n = 57$, $M = 4.5$, $SD = 0.6$), to frequent ($n = 54$, $M = 8.2$, $SD = 2.1$) viewing time, in that order. The assumption of homogeneity of variances was not violated, as assessed by Levene's test for equality of variances ($p = .150$). The social media times were statistically significantly different for different levels of social media groups Welch's $F(2, 91.136) = 228.487$, $p < .001$. There was an increase on social media usage time from the infrequent group ($M = 2.1$, $SD = 0.9$) to the moderate group ($M = 4.5$, $SD = 0.6$), a mean increase of 2.4, 95% CI [2.0, 2.7], which was statistically significant ($p = .001$). There was an increase on social media usage time from the moderate group ($M = 4.5$, $SD = 0.6$) to the frequent group ($M = 8.2$, $SD = 2.1$), a mean increase of 3.7, 95% CI [2.9, 4.4], which was statistically significant ($p = .001$).

Aerobic Capacity

Data is presented as mean \pm standard deviation in table 3. There were no outliers in the data, as assessed by inspection of a boxplot. PACER scores decreased from the infrequent ($n = 53$, $M = 47.6$ $SD = 17.9$), to moderate ($n = 57$, $M = 40.4$ $SD = 18.5$), to frequent ($n = 54$, $M = 38.2$ $SD = 19.1$) for laps completed, in that order. The assumption of homogeneity of variances was not violated, as assessed by Levene's test for equality of variances ($p = .753$). The PACER scores were statistically significantly different for different levels of social media groups, $F(2, 161) = 3.705$, $p = 0.027$. There was a decrease on PACER scores from the infrequent group ($M = 47.6$, $SD = 17.9$) to the frequent group ($M = 38.2$, $SD = 18.5$), a mean decrease of 9.3, 95% CI [.85, 17.7], which was statistically significant ($p = .027$). No statistically significance was observed between the infrequent and moderate groups, and the moderate and frequent groups.

Physical Activity

Data is presented as mean \pm standard deviation in table 3. There were no outliers in the data, as assessed by inspection of a boxplot. Steps per day decreased from the infrequent ($n = 53$, $M = 7965.1$ $SD = 3260.5$), to moderate ($n = 57$, $M = 7629.9$ $SD = 3496.7$), to frequent ($n = 54$, $M = 6312.3$ $SD = 2991.9$) for steps taken per day, in that order. The assumption of homogeneity of variances was not violated, as assessed by Levene's test for equality of variances ($p = .150$). Steps taken per day were statistically significantly different for different levels of social media groups, $F(2, 161) = 3.871$, $p = 0.023$. There was a decrease on steps per day from the infrequent group ($M = 7965.1$ $SD = 3260.5$) to the frequent group ($M = 6312.3$ $SD = 2991.9$), a mean decrease of 1652.9, 95% CI [161.26, 3144.3], which was statistically significant ($p = .026$). No statistically significance was observed between the infrequent and moderate groups, and the moderate and frequent groups.

Discussion and Conclusion

This study examined the differences of total pedometer based physical activity, cardiovascular aerobic capacity, and screen based social media time in college students. Our findings indicated that the quantity of daily social media usage demonstrated differences in steps taken per day and aerobic capacity in college aged students. However, the differences in screen-based sedentary behaviors varied by the duration of screen time. Longer screen time users demonstrated a greater decline in steps per day and a greater decrease in aerobic capacity, and these differences were amplified in the students who engaged in frequent daily use.

Our study found that on average college students spend 4.96 hours per day on social media and our results demonstrated findings similar to a 2023 survey conducted in the United States where teenagers (13-19 years) spent an average of 4.8 hours on social media platforms every day (Rothwell et al., 2023). We found that the frequent users spent as much as 8.0 hours per day average on social media (Facebook, Instagram, TikTok) interacting with the platforms in different ways such as posting content, watching videos and photos, communicating with users, and commenting on content. With this excess usage time we found that college students who were classified as “frequent users” (< 5.61 hours) displayed greater declines in aerobic fitness

markers. The frequent users on average completed 17.3% less steps per day compared to the moderate users and 20.8% less than the infrequent social media users which was statistically significant (data represented in table 3). These differences demonstrate that when college students engage in more sedentary social media time, they are more likely to be classified as “low active” (5000-7499 steps per day) as defined by Tudor-Locke and colleagues (Tudor-Locke et al., 2008). With regards to aerobic capacity, the frequent user group on average completed 5.4% less laps compared to the moderate users and a 19.5% decrease compared to the infrequent users which was statistically significant. These differences between the infrequent users (< 3.50 hours per day) and the frequent users (> 5.61 hours per day) demonstrate that when more time is spent on sedentary behaviors that there is an inverse relationship with aerobic capacity in the frequent social media users.

In conclusion, excess social media leisure time activity has been classified as “sedentary” behavior, and it’s been demonstrated that in college aged students the quantity of this leisure time activity is increasing (Castro et al. 2020; Moulin et al., 2021). Observational evidence suggest that high volumes of sedentary behavior are associated with an elevated risk for all-cause mortality, cardiovascular disease incidence and mortality, type 2 diabetes incidence, and some cancers, particularly among those who are not achieving recommended amount of moderate to vigorous intensity activity (Patterson et al., 2018; Ekelund et al., 2019; Powell et al., 2018). This study demonstrated that with more time spent on leisure time sedentary activities, such as social media use, that students participate in less physical activity and display a lower aerobic capacity.

Limitations

This study was not without limitations. Aerobic fitness was quantified using the PACER test and not through measurement of oxygen uptake which would have provided a better individual quantification. The PACER test can be daunting and challenging for individuals with a running concern or issue, and subjects may not have provided their maximal exhaustion during the test. Social media usage time was quantified by a self-assessed recall for the past week of time during the guided interview and this could have led to an over or underestimate of social media interaction time. Steps per day was quantified using a step pedometer which could have been inaccurate if not used in the prescribed manner.

Author Contributions

P.C. and Z.W. conceived the presented idea. P.C. wrote the manuscript with support from Z.W. R.K., B.M., & R.T., assisted with data collecting and carrying out the experiment. All authors reviewed the manuscript.

Conflict of Interest Statement

We have no conflicts of interest to disclose.

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