



Original Research

Examining the Impact of a University-driven Exercise Programming Event on End-of-semester Stress in Students

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ABSTRACT

International Journal of Exercise Science 10(5): 754-763, 2017. Stress levels in university students peak during the final exam period. An inverse association exists between Physical Activity (PA) and poor mental health. UNLV has created Fitness4Finals (F4F), an event novel in its approach to academic stress reduction by incorporating both physical activity and mental relaxation. To our knowledge, a university-driven programming event aimed at reducing physiological and psychological stress among students approaching final exams had never been studied. Therefore, the aims of this research were to 1) examine the influence of F4F on physiological stress and perceived psychological stress (PPS) and 2) to examine the relationship between physiological stress and PPS. Fifteen full-time university students were recruited to participate in their choice of one of two groups: F4F or control (NonF4F). Pre-F4F and post-F4F measures of physiological stress, measured by salivary cortisol, and perceived psychological stress, measured by survey were collected. The F4F event was held the week prior to final examinations. Participants in the F4F group engaged in one F4F activity per day for the duration of the 3-day event. Results of the repeated measures MANOVA indicated nonsignificant interaction ($p = .864$) between F4F participation, physiological stress and PPS. PPS and cortisol were not correlated at the onset of the study ($r = -0.18$, $p = 0.48$) or at the last sampling period ($r = 0.097$, $p = 0.73$). Preemptive elevated levels of PA in the F4F group may have influenced results. Qualitative data indicates a unanimous perceived reduction in stress from F4F participation. While the physiological measures of stress in the present study were not significantly different, the perceived stress reduction reported by F4F participants is influential. Further investigation with improvements in timing and measurement tools is warranted.

KEY WORDS: Exercise intervention, mental health, exercise physiology, psychophysiology, final exams

INTRODUCTION

The 2015 National College Health Assessment reported stress and anxiety as the two prominent factors affecting individual academic performance, at rates of 30% and 22% respectively (1). Concurrently, 54% of students failed to meet daily exercise recommendations

(30). Furthermore, 32% of students experience even greater levels of stress in times surrounding final exams, as indicated through psychological and physiological markers (24,34). Therefore, attention to both mental health and physical activity (PA) are of utmost importance approaching final exam periods.

Health behaviors acquired during early adulthood predominantly remain for the adult life (2,7,18,19,20). Preventing a decline of and possibly increasing PA early in adulthood is worth acting on as; "low fitness" is the number one predictor of premature death in the United States due to cardiovascular disease (CVD) (6). Additionally, mental stress is reported as a main causal factor of CVD (35). Furthermore, it is possible for a mental illness, such as trait anxiety and depression, formed during the college years to persist throughout one's lifetime, particularly if mismanaged or unaddressed. Reverberations of poor mental and physical health may manifest in social and occupational troubles, causing continued interference in overall health and functioning (29).

Although mental health and physical activity are distinct areas of health, these areas are correlated. An inverse association exists between PA in college and both poor mental health (adjusted odds ratio (OR): .79, 95% confidence interval (CI)) and perceived stress (OR: .75; 95% CI)(31). Mood boosting and stress reduction benefits have been shown as a result of exercise bouts both long and short in duration, spanning intensity levels from light to vigorous (15). Within this population, increases in PA have also been linked to increases in mental health inclusive of reduced state and trait anxiety, depression and perceived stress (30). Therefore, the ideal intervention is one concentrated around final exams that promote both physical activity and stress reduction.

The research presented correlating PA and stress among college students is vastly based on self-reporting of both perceived stress and time engaged in PA (5,13,21,33). A small number of studies examined participation in physical activity as a college course (3,4). In 2016, a study by de Vries et al. showed that implementation of a 6-week, low intensity exercise intervention reduced study fatigue in university students (10). To our knowledge, just one PA intervention exists with the aim of reducing both psychological and physiological stress specifically during the final exam period, though the effectiveness of this intervention has not yet been studied.

In fall 2014, the University of Nevada, Las Vegas (UNLV) created a novel pilot program, "Fitness4Finals" (F4F; by Sharon Jalene, licensed under CC BY NC ND 4.0, a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License), as a 3 day, on-campus PA intervention to reduce final exam stress levels (12). The program has since been held the week preceding final exams during fall and spring semesters and consists of light, moderate and vigorous PA options along with meditation, healthy snacks, and informational booths promoting a variety of health behaviors.

It is possible that participation in one F4F event may help reduce acute psychological and physiological stress. Repeated participation in F4F events throughout one's college career may create a lifelong health behavior of seeking PA at times of high stress. Semi-annually, 28,000

students on the UNLV campus alone experience significantly elevated levels of stress simultaneously. The possible effectiveness of a program such as F4F in helping students to reduce and cope with this stress could prove beneficial on a multitude of levels, with possible positive affects on academic performance (27), mental health, social health and physical health (6,10,27).

The effectiveness of end-of-semester programming (such as F4F) in reducing stress levels has not been tested. Therefore, the primary aim of this research was to examine the influence of a university-driven exercise-programming event on physiological stress and perceived psychological stress. A secondary aim was to examine the relationship between students' physiological stress and PPS. Findings of this research have the potential to provide a scientific foundation for instituting this type of event on U.S. college campuses to increase PA and reduce final exam stress. In addition, it is possible that repeated participation in exercise event programming throughout one's college career might result in an acquired health behavior to seek PA and healthy stress reduction techniques during times of high mental stress.

METHODS

Participants

This study was quasi-experimental in nature. Participants were allowed the choice to participate or refrain from participation in the Fitness4Finals event, making this a 2-group nonrandomized trial. Participants were also allowed to maintain any regular PA activity.

The study inclusion criterion was as follows: university students enrolled full-time and in "good health" as defined by the ACSM American Heart Association Questionnaire. Students with contraindications to exercise were excluded from participation in the F4F group but were allowed to participate in the nonF4F group.

Participants were recruited from undergraduate and graduate courses. Number of goal participants was unknown, as a study of this nature has never been performed. Therefore, researchers did not set a minimum of maximum number of participants. A total of 17 students volunteered for the study, with 15 completing the study in its entirety: 7 students in the control and 8 students in the F4F participation group. Institutional Biomedical IRB approval was granted prior to recruitment and data collection, and all participants provided written informed consent.

Table 1. Participant demographics by group.

	Height (cm)	Weight (kg)	Age (years)
Control	173.7±4	80.9±12	27.7±6
F4F	168.0±15	73.5±15	28.9±7

Protocol

Data was collected surrounding the F4F event during the Fall 2015 semester. Participants volunteered on a basis of intent to participate in Fitness4Finals (F4F/experimental group) or to refrain from participation in Fitness4Finals (nonF4F/control group). Demographic data (Table

1), average weekly engagement in PA and average weekly engagement in sedentary study were self-reported by students prior to the F4F event.

F4F is held during the UNLV study week, which is the period of time just preceding final exam week. It is a 3-day on-campus event (Tuesday - Thursday). Daily events include light, moderate and vigorous exercise options, meditation classes, healthy snacks and informational booths on differing health topics. Exercise offerings vary in intensity, modality and duration. During this particular F4F event, light intensity exercises included yoga (50 minutes in duration, see figure 1), Pilates (50 minutes), and Thai-chi (50 minutes). Moderate intensity offerings included fitness walking (50 minutes), stair climb (10-30 minutes) and participation in the Flash mob (4 minutes). High intensity offerings included boot camp (50 minutes, see figure 2), cardio kickboxing (50 minutes) and obstacle course (1.5 - 5 minutes). Certified practitioners implemented all classes. Students representing differing clubs and departments, such as Nutrition Sciences, Student Government and Kinesiology, ran the informational booths, provided healthy snacks, and advocated healthy lifestyle behaviors.



Figure 1. Example yoga class held during Fitness4Finals available to students.



Figure 2. Example boot camp held during Fitness4Finals available to students.

Students in the F4F group were instructed to participate in a minimum of one F4F activity per day for the duration of the 3-day F4F event. Students in the control group were asked to continue with their normal schedule and to adhere to their decision to refrain from participation in F4F activities.

Measures of physiological stress and PPS were taken Pre-F4F (baseline) and post-F4F. The F4F event occurred Tuesday, Wednesday and Thursday, the week preceding final exams. Pre-F4F collection occurred on Monday, prior to F4F and post-F4F collection occurred on Friday, following the conclusion of F4F.

PPS is an aggregate score obtained from Cohen's Perceived Stress scale survey (1983). This is the most widely used psychological instrument for measuring the perception of stress; with ten items designed to identify how unpredictable, uncontrollable, and overloaded participants find their lives. Example questions include: "In the last month, how often have you felt that you could not cope with all the things you had to do?" and "In the last month, how often have you felt that you were on top of things?" Participants chose their answers from a Likert scale

ranging from 0 (Never) to 4 (Very often). Scores were obtained by reversing responses to the four positively stated items and the summing across all scale items. Higher total scale scores indicated higher PPS.

Physiological stress was measured via cortisol levels in whole saliva, collected through the passive drool method. Cortisol was assessed using a commercially available kit as instructed by the manufacturers (Salimetrics, Carlsbad, CA). As cortisol levels rise and fall in a natural circadian rhythm, participants were required to provide saliva samples within the same two-hour time frame on both pre and post collection days. Levels of cortisol rise independently of circadian rhythm in response to stress. Levels were compared to known "normal" cortisol ranges, dependent on age and gender.

Perceived reduction in stress as a result of participation in Fitness4Finals was also assessed qualitatively. Participants in the F4F group provided a written answer to the question, "do you feel that participation in Fitness4Finals events helped to reduce your end-of-semester stress?" Participants could respond "yes," "no," or "indifferent," with the option to elaborate open-endedly.

Choice of F4F event and therefore exercise mode and intensity, varied within and between F4F participants. Current research concludes that exercise intensity does not moderate the antidepressant response to acute exercise (17). These findings, combined with the lack of feasibility to monitor actual intensity per participant per event mediated our choice to forgo inclusion of this data.

Statistical Analysis

Participation in F4F served as the dichotomous independent variable, and PPS and physiological stress served as repeated continuous dependent variables, measured at pre and post time points. Due to the relatable nature of the dependent variables, they were examined simultaneously. This analysis includes both between and within subject measurements. As such, data were analyzed using a doubly repeated measures multivariate analysis of variance (MANOVA). Similarly, PPS and physiological stress data were analyzed for correlation using a mixed-measures ANOVA.

Statistical analyses were completed using SPSS, version 24 with significance at the $p < 0.05$ level. Qualitative data was collected from F4F participants by means of survey during the final data collection.

RESULTS

Upon entrance to the study, participants in the F4F group reported higher mean weekly engagement in PA and lower mean weekly engagement in sedentary study (Table 2).

Table 2. Hours of weekly engagement in PA and sedentary study per group.

	PA (h)	Sedentary Study (h)
Control	7.33±5.2	13.0±9.4
F4F	9.86±6.42	7.68±6.0

Statistical results indicated a nonsignificant group × time interaction $F = .147, p = .864$. Additionally, $\eta^2 = .024$ indicated the interaction effect between PPS and physiological stress was not substantial.

PPS and cortisol were not correlated at the onset of the study ($r = -0.18, p = 0.48$) or at the last sampling period ($r = 0.097, p = 0.73$) (Table 3). Mean scores revealed lower PPS from the F4F group across time points.

Table 3. Mean stress measurements by group at pre and post time points.

	Pre F4F	PostF4F
Control		
Salivary Cortisol (PS) (µg/dL)	0.306±0.17	0.264±0.16
Perceived Stress Scale (PPS)*	16.71±6.2	15.29±4.7
F4F		
Salivary Cortisol (PS) (µg/dL)	0.373±0.19	0.286±0.16
Perceived Stress Scale (PPS)*	12.38±4.6	11.63±3.7

(PS) = physiological stress; (PPS) = perceived psychological stress. *Possible total point score range = 0 (not stressed) to 40 (very stressed).

Eight out of the eight F4F participants answered “Yes” to the qualitative question “Do you feel that participation in Fitness4Finals events helped to reduce your end-of-semester stress?” Furthermore, seven of the eight F4F participants chose to elaborate on their response (Table 4). Comments present a common theme of mental relaxation as a result of participation in F4F.

Table 4. Qualitative responses: "Do you feel that participation in Fitness4Finals events helped to reduce your end-of-semester stress?"

Participant	Response	Comment
2	Yes	The ability to check out of my day with a group of people with a common goal.
6	Yes	I used to be an athlete, so I was used to high intensity, high stress exercise. The Pilates and yoga classes did help me feel that high and reduce my stress.
7	Yes	The meditation event was very helpful in reducing stress and gave ways to continue to cope with and de-stress in the future. Working out also helped because it felt like I was still sticking to a routine.
8	Yes	I was able to clear my mind and it helped me focus more when I did have to sit down and study.
9	Yes	I was very excited for the flash mob, a good break from seriousness of studying. I felt mentally relaxed after yoga and meditation.
13	Yes	It gave me an active outlet and break from schoolwork.
16	Yes	(Did not provide comment)
17	Yes	I felt compelled to relax my mind.

DISCUSSION

The primary aim of this investigation was to determine if college students participating in an end-of-semester university-driven exercise programming event would report lower physiological and psychological stress leading into final exams. According to our analysis, no correlation exists between participation in F4F and physiological and psychological stress reduction. These findings are inconsistent with past research, which show strong correlations between physical activity and stress reduction (3,4,5,10,13,21,23,33,34).

Results showed a lack of correlation between physiological stress and PPS. This finding aligns with past research, which has found the association between perceived and physiological stress to be weak and divergent (9,14,16,22,28). Oldenhinkel et al. found changes in cortisol levels with perceived arousal and unpleasantness ($F(3,586)=76.0, p<.001$) (22). Conversely, Cohen et al. found no association between cortisol and changes in anxiety in response to stressors (9). Additionally, sixty percent of quality field studies assessed by Hjortskov et al. showed no association between self-reported mental stress and salivary cortisol response; thirteen percent reported negative association and twenty-seven percent reported positive association (14).

Future research with adjustments in stress measuring tools is warranted to clarify the qualitative and quantitative results. A perceived stress measurement tool with specific measurement focus on academic stress may provide more accurate assessment of end of semester stress. A more acute measure of physiological stress may be seen through salivary alpha-amylase or salivary pH, as opposed to salivary cortisol (8,26,29). Lastly, the addition of a baseline stress reading prior to end-of-semester collection could add validity and strength to findings. As this was a pilot investigation, further research with increased subject numbers is warranted.

Discrepancies between our findings and past research could infer that F4F does not impact stress levels in student participants. However, qualitative data provides an alternate view as 100% of F4F participants self-reported feeling a reduction in their perceived level of stress following participation in the event, with communal emphasis on mental relaxation. This leads us to believe that the physiological measures of stress taken in this study do not adequately reflect the overall sensation experienced by participants. Mean data per group may indicate that students, who inherently choose to engage in greater amounts of PA, also choose to participate in F4F. This elevation in PA may explain the lower levels of PPS and slightly higher cortisol levels. Decreases in PPS for the F4F group may not be seen as their baseline scores are preemptively depressed. Steady engagement in PA (prior to and during F4F) may prevent a decline in cortisol levels, as this is a byproduct of exercise. Additionally, an emerging theory relating to fatigue proposes a two-compartment taxonomy comprised of physiological fatigue and perceived fatigue (11). While more investigation is necessary, it is possible that an analogous relationship exists with regard to stress. It is possible that while the physiological measures of stress in the present study were not significantly different, the perceived stress reduction reported by the F4F participants is influential.

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