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Measuring the Impact of a Weeklong Fall Break on Stress Physiology in First Year Engineering Students

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Measuring the Impact of a Weeklong Fall Break on Stress Physiology in First Year Engineering Students

Abstract

Canadian post-secondary institutions are increasingly introducing a fall break into their term calendars, with the stated goal of reducing student stress and improving academic success. We conducted a pilot study around the time of this fall break during which we collected saliva samples to measure the ratio of two metabolic hormones (cortisol and dehydroepiandrosterone (DHEA)) from first-year male engineering students in order to document possible changes in their stress levels before and after the break. Participants self-identified a particular day in the week prior to the break that they considered to be most stressful, followed by a day in the week after the break that was perceived to be equally stress-inducing. A control sample of student engineers was recruited from another university with equivalent academic rigour but without a fall break. Students who experienced the fall break exhibited a marginally lower ratio of cortisol to DHEA after the break than did those who did not experience the break indicating a difference in psychological stress. Since fall breaks are now increasing in popularity, we make the recommendation that it is imperative to empirically investigate their impact on student mental health.

Un nombre de plus en plus grand d'établissements post-secondaires introduisent un congé d'automne dans leur calendrier, avec l'objectif déclaré de réduire le stress des étudiants et d'améliorer la réussite académique. Nous avons mené une étude pilote aux alentours de ce congé d'automne au cours duquel nous avons recueilli des échantillons de salive auprès d'étudiants mâles de première année en génie afin de mesurer le ratio de deux hormones métaboliques (le cortisol et la déhydroépiandrostérone - la DHEA)) et pour documenter les changements possibles dans leurs niveaux de stress avant et après le congé. Les participants ont identifié eux-mêmes un jour spécifique de la semaine avant le congé qu'ils considéraient comme étant le plus stressant, suivi par un jour particulier de la semaine après le congé qu'ils percevaient comme étant aussi stressant. Un échantillon témoin d'étudiants en génie a été recruté dans une autre université où la rigueur académique était équivalente mais où il n'y avait pas de congé d'automne. Les étudiants qui ont bénéficié d'un congé d'automne ont manifesté un ratio plus bas de cortisol par rapport à la DHEA après le congé par rapport aux étudiants qui n'avaient pas bénéficié d'un tel congé, ce qui indique une différence de stress psychologique. Étant donné que la popularité des congés d'automne est en augmentation, nous recommandons qu'il est impératif d'établir empiriquement leur impact sur la santé mentale des étudiants.

Keywords

fall break, student stress, student mental health, cortisol, DHEA

Cover Page Footnote

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"Providing a small reprieve from classes at a critical time in the academic year will supply students with a chance to 'catch-up' on their studies and to improve their work. The importance of this factor should not be underestimated as a measure for reducing students' stress." (The University of Western Ontario - Harvey & McGuire, 2012)

Post-secondary students in Canada report higher levels of psychological distress than the general population (Adlaf, Gliksman, Demers, & Newton-Taylor, 2001; Stallman, 2010), and stress and anxiety in this group has increased in recent years (Booth, Sharma, & Leader, 2015). A 2016 report assessing well-being in over 25,000 students across 20 Canadian post-secondary institutions revealed that students are in a state of crisis. A total of 61.4% of respondents felt hopeless, 89.2% felt overwhelmed, 87.8% felt exhausted, 65.4% felt overwhelming anxiety, and 13.7% had seriously considered suicide within the last twelve months. Students reported that the top four factors impacting their mental health were academics, finances, sleep difficulties, and career related issues (American College Health Association, 2016). With over 1.7 million individuals registered at post-secondary institutions (Universities Canada, n.d.) it is imperative to focus on the mental well-being of our students.

In response to the needs of students, universities and governments are implementing mental health promotion initiatives. Brock University's online portal provides wellness resources for students (More Feet on the Ground, n.d.), and McMaster University's COPE program educates students and encourages communication about mental health (COPE McMaster, n.d.). Universities are also training staff and faculty to meet the needs of students: the University of Guelph provides online modules teaching about mental health (University of Guelph, n.d.), and Queen's University circulates a brief document with guidelines for staff to identify and respond to students experiencing mental distress (Queen's University, n.d.). On a broader scale, the Ontario government funds an organization that helps post-secondary institutions develop programs to support student mental health (Centre for Innovation on Campus Mental Health, n.d.) and provides a free, confidential, and anonymous helpline for post-secondary students (www.good2talk.ca). Students also recognize the need for mental health supports: the Canadian Alliance of Student Associations released a policy paper requesting federal government intervention to create a mental health policy with an exclusive focus on post-secondary students (Max & Waters, 2018).

Across Canada, one of the most consistent university interventions to support student mental health is the introduction of a multi-day fall break. Historically, Canadian universities hold a winter "reading week" break, but the fall semester progresses without a break. Recently, this has changed under the assumption that a mid-semester break supports student mental health and well-being (e.g., Cramer, Pschibul, & Tavares, 2015; McMaster University, 2015). Following a year in which several students died by suicide, Queen's University developed a task force to advise on campus supports for student mental health; the inclusion of a fall break was one recommendation stemming from that report (Clapham, Jahchan, Medves, Tierney, & Walker, 2012). Fall breaks are now becoming the norm: upon our review of the websites of 70 Canadian universities, 52 indicated that some form of a break would occur in the 2017 fall term.

Given the wide-scale adoption of fall breaks, it is now critical to investigate whether implementation of such a break does in fact improve the mental health and well-being of students. There is minimal work investigating this, although students at Brock University self-reported decreased stress due to the fall break and no increases in workload (Pilato, 2014). Additionally, researchers at the University of Windsor used smartphone notifications to track student time around the fall break and found that post-break stress correlated with stress before and during the break, post-break workload, and recreational activities during the break

(Cramer, Pschibul, & Tavares, 2016). Nonetheless, more empirical work is required to assess the effects of a fall break on multiple student outcomes.

Considering the usefulness of conducting exploratory studies prior to launching full-scale research (Van Teijlingen, Rennie, Hundley, & Graham, 2001), we have run a preliminary analysis of the fall break using one component of well-being: student stress. Stress may be defined as any situation that interrupts the equilibrium between a living organism and its environment (Ranabir & Reetu, 2011). There is extensive literature demonstrating negative associations between stress and mental health (Backović, Živojinović, Maksimović, & Maksimović, 2012; Bovier, Chamot, & Perneger, 2004; Misra, McKean, West, & Russo, 2000; Tennant, 2002), learning and memory (Joëls, Wiegert, Oitzl, & Kruger, 2006; Kuhlmann, Piel, & Wolf, 2005; McEwen & Sapolsky, 1995; Schwabe, Joëls, Roozendaal, Wolf, & Oitzl, 2012; Talib & Zia-ur-Rehman, 2012; Vogel & Schwabe, 2016), and overall health (Stein & Miller, 1993; Willenberg, Bornstein, & Chrousos, 2000). Therefore, stress is a highly relevant marker of mental health functioning for a student population (Beiter et al., 2015).

Stress can be easily measured through noninvasive hormone measures in saliva samples (Shirtcliff, Granger, Schwartz, & Curnan, 2001; Smyth, Hucklebridge, Thorn, Evans, & Clow, 2013). Instead of depending on self-reports of experiences, we used real-time biomarkers of stress: salivary cortisol and dehydroepiandrosterone (DHEA). This approach provides a more valid representation of stress than subjective measures alone.

Method

First-year male engineering students at two universities were recruited through posters and in-class announcements. Within-group variance in hormonal output was controlled by including only males (lack of a menstrual cycle) and only first-year engineering students, who all have a comparable class schedule, resulting in similar routines and academic deadlines. The students at one university did not have a fall break but have similar entrance and course requirements to those of the other university; they served as a control group. This research was approved by the Research Ethics Boards at both institutions, conforming to standards of ethical conduct in research involving human participants.

All participants were given 10 1.5ml saliva collection microtubes and were asked to identify a day in the week before the break that they considered to be most stressful and a day in the week after the break that they considered equally stress-inducing. Students were instructed to go to sleep between 10-11:30 p.m. on the night before their selected days, to wake at 7 a.m., and to attend all classes on those days. They were asked to collect saliva using a modified version of the passive drool technique (Granger et al., 2007): to avoid eating around the time of saliva collection and to drool directly into a microtube at 7 a.m., 9 a.m., 12 p.m., 3 p.m., and 8 p.m. on each of their two self-identified days. Sixteen participants returned the full, sealed vials to a dropbox on campus. Samples were stored at room temperature before being shipped to the University of New Orleans (Louisiana, USA) for hormonal analysis of DHEA and cortisol using standardized enzyme immunoassay kits purchased from Salimetrics® (Pennsylvania, USA).

Results

Cortisol and Dehydroepiandrosterone (DHEA)

We first analyzed each hormone individually using a 2 (Presence or Absence of a Fall Break) x 2 (Time: The Week Before or After a Fall Break) mixed-model ANOVA. Cortisol levels indicated no significant main effect of Timing or Presence/Absence of a Fall Break, and no interaction (*p*s > .129). Similar patterns were seen in the analysis of DHEA levels (*ps* > .165).

Ratio of Cortisol to DHEA

Next, we calculated ratios of cortisol to DHEA, since some literature suggests that the balance between these hormones is a more informative indicator of mental health (Markopoulou et al., 2009; Shirotsuki et al., 2009). Here, we observed a significant interaction between Presence or Absence of the Fall Break and Time, $F(1,7)=5.581$, $p=.05$, such that at pre-break there was no significant difference between the two student groups (*p*s > .171); however, at post-break, there was a marginally greater hormone ratio for students at the university without a fall break ($M=44.86$, $SD=37.77$) than at the university with a fall break ($M=10.01$, $SD=5.77$), $F(1,7)=4.263$, $p=.078$. As well, those students that did not experience a break had marginally greater Cortisol/DHEA levels at post-break ($M=44.86$, $SD=37.77$) than pre-break ($M=7.70$, $SD=6.81$), $F(1,7)=5.456$, $p=.052$.

Discussion

Our findings indicate a marginal effect of the fall break on stress hormones. Engineering students at the university that did not have a weeklong break (control group) had a slightly greater output of cortisol to DHEA than those that experienced time away from school (experimental group). Although 60 participants were recruited for the study, we had a low compliance rate with five participants in the control sample and 11 participants in the experimental sample. Due to our low sample size, we are cautious in our interpretation of the data. We do however consider our preliminary findings promising for the exploratory phase of our study, as they provide some evidence that a fall break may offset a typical increase in stress during the term.

Based on our current analysis, we believe that the ratio of stress hormones cortisol and DHEA is a more informative measure of the stress response than that provided by either hormone individually, and we recommend that it be considered by other investigators in similar fields of research. Moreover, we have a specific recommendation for university and college instructors to review the scheduling of their tests, assignments, and other deliverables around timing of the fall break since stress might have a wide range of effects on student learning. For example, in one study, a sample of university students that experienced a stressor directly before a memory test had a negative impact on the retrieval of recently learned information (Schwabe & Wolf, 2009). Accordingly, it might be worthwhile to implement a test ban several days before the break when student stress is high and even after the break to allow for transition into regular routines. If the majority of students in a course are enrolled in a similar program, as was the case with our participants, it might make sense to schedule some course components in consultation with other instructors from the program or department so that there is an even distribution of workload before and after the break.

Hormones are inherently variable chemicals with marked inter-individual and intra-individual variation (Norris, 1997). We observed large dispersions in hormone values in our participants. Accordingly, our focus during the next phase of our study is to increase our sample size so that our data may allow us to make robust and more generalizable conclusions. We hope to ensure better compliance by providing multiple locations on campus for depositing saliva samples. Finally, we further hope to correlate the hormonal data with perceived stress as reported through questionnaires in order to assess whether there is alignment between objective and subjective measures of student stress. Given the widespread occurrence of fall breaks, we believe that this work is critical to support evidence-based approaches to the development and implementation of student-centred policies at post-secondary institutions.

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