In-Class Stretching Break to Augment College Students' Comfort and Reduce Mental Workload

College students spend an average of 63% of their school time in sedentary positions, with those in highly demanding majors like medicine spending at least 7.29 hours a day. Prolonged sitting is associated with adverse health outcomes, a growing concern in the education sector due to the continuous increase in academic and leisure activities performed in sedentary positions. Although stretching breaks have been shown to effectively mitigate the effects of prolonged sitting in non-academic settings, their efficacy in academic environments remains underexplored. Moreover, there is no consensus on how and when to take such breaks. This pilot study examined the effectiveness of a 1.5 min stretching break at 40 min in reducing perceived discomfort and mental workload during 80 min sedentary computer typing tasks. Participants were college students randomly divided into stretching and control groups. Perceived discomfort and mental workload were measured using Borg's CR-10 and NASA-TLX scales, respectively. Results showed that participants in stretching group reported lower discomfort and mental workload levels, suggesting the potential effectiveness of stretching breaks in interrupting prolonged sitting. This preliminary evidence offers the possibility of incorporating stretching breaks intervention to create a more comfortable and mentally supportive learning environment in colleges and universities.

INTRODUCTION

Higher education has undergone significant transformation in the last decades, resulting in the growth of academic activities performed in sedentary positions, including sitting, reclining, standing and lying postures. College students spend an average of 63% of their school time in sedentary positions (Egan et al., 2019), with those in high demanding majors like medicine spending at least 7.29 hours of their day in seated postures (Castro et al., 2020). Increased sedentary time among young adults can also be attributed to limited time for physical activities (Alwashmi, 2023; Castro et al., 2020) as more than half of them are physically inactive (Nelson et al., 2019).

Prolonged sitting is associated with heightened discomfort and fatigue (Ladeira et al., 2023), decline in cognitive function (Hanna et al., 2019) and adverse health outcomes, including cardiovascular diseases and musculoskeletal disorders (Alwashmi, 2023; Carter et al., 2017). Common complaints among college students include shoulder stiffness (40%), lower back pain (46.8%), wrist strains and neck pain (60.8%) (Alsalameh et al., 2019). The complaints are even higher among medical and healthcare sciences students (Ladeira et al., 2023).

Although recent studies have pointed out the potential benefits of in-classroom physical exercises like stretching in enhancing students' comfort and well-being (Keating et al., 2020; Plandowska et al., 2024), current research focus is primarily on the effectiveness of stretching in non-academic settings like office and workplace environment. This study sought to address this research gap by evaluating the effectiveness of in-classroom stretching breaks in mitigating the effects of prolonged sitting in college students. Specifically, the study examined the effectiveness of a 1.5 min stretching break at 40 min in reducing perceived discomfort and mental workload during 80 min sedentary computer typing tasks. It was hypothesized that stretching breaks could alleviate discomfort and reduce mental workload that are often associated with prolonged sitting in academic settings.

LITERATURE REVIEW

Empirical evidence from non-educational fields has demonstrated that stretching breaks are generally effective for immediate and long-term mitigation of the effects of prolonged sitting. Benefits include improved worker well-being and productivity (Henning et al., 1997), immediate muscles recovery (Ding et al., 2020) and reduced back strain and overload (Sortino et al., 2024). Most of these studies employ two types of stretching breaks: short and frequent breaks of 15 – 60s more than once per hour and a one-time break of 30s – 3 mins, depending on the target activity and workplace setting (Ding et al., 2020; Hallbeck et al., 2017; Sortino et al., 2024). However, there is no consensus on when and how to take the breaks (Ding et al., 2020). One plausible reason lies in the different contexts in which these studies are carried out. Additionally, their effectiveness in academic settings is underexplored, with most of the few studies reported conducted in uncontrolled environments (e.g, Keating et al., 2020; Plandowska et al., 2024). To provide a comprehensive understanding of the implications of stretching breaks in colleges, it is imperative to conduct these experiments in controlled environments to mitigate the confounding effects of external variables.

Table 1. Summary of participant demographic information. Mean (SD).

Group	Age (years) M (SD)	Height (cm) M (SD)	Weight (kg) M (SD)
All (n = 16)	24.81 (1.87)	171.25 (14.02)	75.29 (16.96)
Female (n = 6)	24.00 (1.67)	156.00 (5.87)	63.50 (9.99)
Male (n = 10)	25.30 (1.89)	180.40 (7.77)	82.36 (16.61)
Stretch (n = 8)	24.25 (2.19)	170.97 (14.37)	72.80 (11.64)
Control (n = 8)	25.38 (1.41)	171.53 (14.66)	77.78 (21.61)

METHODS

Participants

Sixteen healthy participants were recruited from the university student community and randomly divided into stretching and control groups. Inclusion criteria included enrolled undergraduate or graduate students aged 18 and above with no physical disability or medical conditions that prevented them from participating in the study. They all provided written consent before starting the experiment. Table 1 provides a summary of participant demographic information.

Equipment

The equipment used in this study was an adjustable workstation equipped with an adjustable chair and a Dell desktop computer model running on Windows 10 operating system. The study utilized two data collection instruments. The participants' subjective discomfort levels in various body regions were measured using Borg's CR-10 scale. This 10-point Likert scale ranged from 0 (no discomfort) to 10 (extremely discomfortable). The mental workload was measured using The National Aeronautics and Space Administration Task Load Index (NASA-TLX) across six dimensions: mental, physical, temporal, performance, effort and frustration demands (Hart and Staveland, 1988). The experiment setup is shown in Figure 1.

Dependent and Independent Variables

The study employed a between subject experimental design with stretching break being the independent variable that was manipulated (stretching vs control). The independent variables were the perceived discomfort at various body regions and the self-reported mental workload.

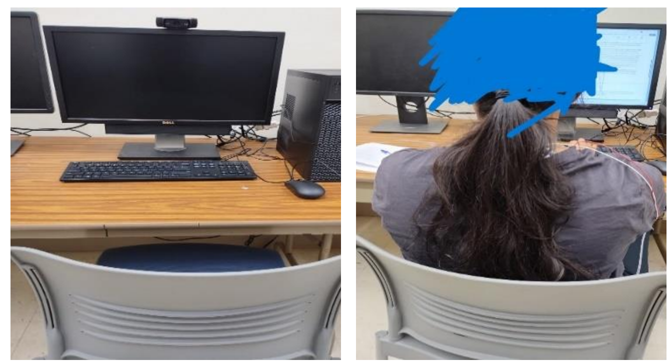

Figure 1. Experiment workstation (left) and the setup with a right-handed subject carrying out the task (right).

Stretching Protocol

The stretching protocols were of the same intensity and duration and targeted the neck, shoulders and wrist regions, all adapted from the recommendation by The United States National Institute of Health (NIH, 2024). Neck stretches involved simple neck rotations in a standing position with shoulders still for two sets of 10s each with a 5s break. Shoulder stretches involved two sets of shoulder rolls performed in an upright posture, each 10s with a 5s break. Wrist stretches involved two sets of straightening one hand in front, rotating it inwards and bending the wrist back with the other hand and holding for 5s, with a 5s break between the sets. The same was repeated for the other hand. This was a total of 1.5 min stretching intervention (30s for neck, 30s for shoulder and 30s for wrist). The stretching group had a 1.5-min stretching break at 40-min, while the control group had no break and remained seated throughout the experiment. The 1.5-minute stretching break was chosen based on evidence that breaks (30 – 180s) reduce discomfort and workload without disrupting task flow (Henning et al., 1997; Waongenngarm et al., 2018) and are generally practical in educational settings.

Experiment Design

The experiment was conducted in a laboratory setting. It lasted 80-min per participant because most college lectures last between 30 – 120 mins (Bradbury, 2016), and prolonged sitting results in discomfort after 1 – 2 hours of continuous sitting (Ding et al., 2020). The break was set at 40 min because musculoskeletal discomfort occurs after 30 – 50 min of prolonged sitting (Arippa et al., 2022; Ding et al., 2020; Sortino et al., 2021). Participants were scheduled at their convenience. The total protocol lasted about 2 h.

After providing consent, all participants completed a preliminary demographic and anthropometric questionnaire. Before the experiment, each participant adjusted the chair, monitor, keyboard and mouse to suit their body dimensions and comfort preferences. No further adjustments were permitted during the 80-minute session to maintain consistency. The typing task involved reading and typing the content of a 10-page single-spaced scanned pdf document into a word processor. Prior to starting the typing task, baseline measurements for discomfort and workload were collected at 0-min. Subsequent discomfort and workload measurements were collected at 20 min intervals: 20 min, 40 min, 60 min and 80 min. The stretching group had a 1.5-min stretching break at 40-min, while the control group had no break and remained seated throughout the experiment. Data was also collected after the break at 41.5 min for both groups, even though the control group did not take a break. This was done to compare the data during the analysis. To isolate the effects of the stretching intervention, participants were instructed to minimize unnecessary body movements (e.g. repositioning and fidgeting) during the session. While some degree of natural micro-movements was expected, participants who engaged in excessive movement or did not adhere to the instruction were excluded from the final analysis. This measure was taken to reduce variability in discomfort and workload ratings that could arise from uncontrolled postural adjustments.

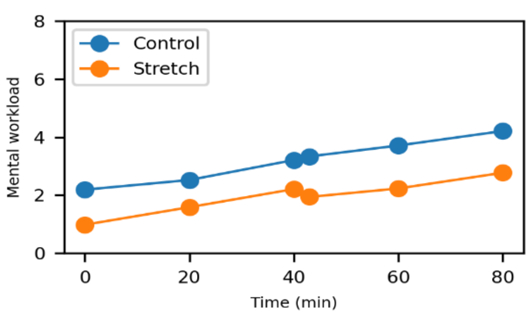

Figure 2. Overall mental workload changes over time.

RESULTS

The raw data from the discomfort and mental workload questionnaires were compiled at participant and group level. Independent samples t-tests were conducted to compare the differences in stretching and control groups. Analyses focused on measurements at the final time point (T5) and the overall mean values as these reflected the cumulative impact of the intervention.

Mental Workload

Mental workload for both groups increased gradually from the start to the intervention time (40 min), after which the mental workload levels for the stretching group were lower (Figure 2). An independent sample t-test showed no significant difference ($t(11) = 1.983$, $p = 0.073$) in the mental workload at timepoint T5 (80 min) between the stretching group ($M = 2.771$, $SD = 1.008$) and the control group ($M = 4.208$, $SD = 1.786$). While the stretching group ($M= 1.951$, $SD = 0.828$) reported lower average mental workload compared to the control group ($M = 3.194$, $SD = 1.860$) across the timepoints (T0 – T5), the difference was not significant ($t(10) = 1.727$, $p = 0.116$).

Perceived Discomfort

Although both groups reported an increase in overall perceived discomfort ratings from the experiment start to the intervention time, the stretching group reported lower discomfort levels after the stretching intervention (Figure 3). A similar trend was observed for the average discomfort level in the target body regions: neck, shoulders and wrists (Figure 4). The average perceived discomfort across all time points (T0-T5) was significantly lower in stretching group ($M = 1.491$, $SD = 0.432$) compared to control group ($M = 2.991$, $SD = 1.450$), $t(8) = 2.805$, $p = 0.022$). Similarly, there was a significant difference in discomfort at T5 ($t(9) = 3.244$, $p = 0.010$), with the stretching group ($M = 2.306$, $SD = 0.736$) reporting lower discomfort than the control group ($M = 4.556$, $SD = 1.818$).

A comparison between the perceived discomfort levels at the various target body regions at 80 min time point (Table 2) showed that the stretching group reported significant lower discomfort levels in the neck, left shoulder, left wrist and right shoulder regions. However, while discomfort in the right wrist was lower for the stretching group, the difference was not statistically significant. The neck reported the highest discomfort levels in both groups.

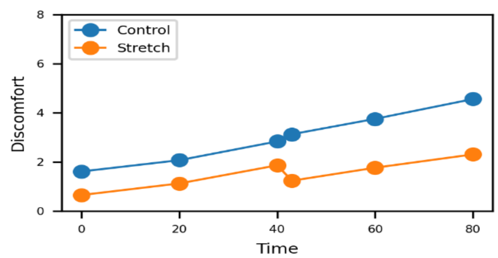

Figure 3. Changes in the overall perceived discomfort with time.

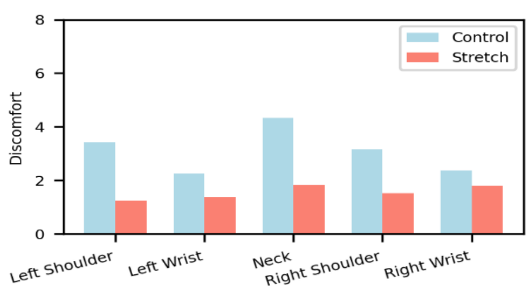

Figure 4: The average perceived discomfort for the target body regions during the entire experiment.

DISCUSSION

This study investigated the effects of a 1.5 min stretching break set at 40 min on the perceived discomfort and mental workload of college students during an 80 min prolonged sitting involving a computer typing task. On average, participants in the control group reported a gradual increase in perceived discomfort levels throughout the experiment, while those in stretching group reported a decrease after the stretching break.

Table 2. Comparison of the perceived discomfort level at T5 (80min) time point between the control group and the stretching group.

	Control M ± SD	Stretch M ± SD	t-value	P-value
Neck	6.25 ± 2.493	2.875 ± 1.246	3.425	0.006
Left Shoulder	4.875 ± 2.100	2.000 ± 0.756	3.643	0.005
Left Wrist	3.875 ± 2.031	2.000 ± 0.926	2.376	0.039
Right Shoulder	4.625 ± 2.560	2.375 ± 0.744	2.387	0.043
Right Wrist	3.625 ± 1.408	3.000 ± 1.512	0.856	0.407

These results supported the study hypothesis that stretching breaks could reduce perceived discomfort during prolonged sitting, corroborating those of the existing studies (Ding et al., 2020; Magnon et al., 2018; Plandowska et al., 2024; Sortino et al., 2024; Waongenngarm et al., 2018). Thus, taking stretching breaks from extended academic activities like classroom lectures or personal studying could reduce discomfort and mental workload among students.

Furthermore, participants in the stretching group reported decreased levels of average mental workload after the stretching break compared to those in the control group, indicating that the break was not only effective in reducing discomfort but also mental fatigue. According to Magnon et al. (2018), physical exercises can reduce mental fatigue and improve cognitive function. Moreover, cognitively demanding tasks like typing often lead to heightened mental fatigue during the duration of the task (Borragán et al., 2017).

Individual variabilities were noted. The mental workload ratings across the six NASA-TLX dimensions varied between participants, even though they pointed towards the same trend observed at the group level. This could be attributed to the potential resiliency of some participants to mental fatigue during tasks performed in sedentary positions. In general, the study findings align with those reported in systematic reviews (Waongenngarm et al., 2018).

Despite the strong design, some limitations that could influence the findings and their generalizability to the entire student population were identified. The small sample size was the major limitation, as it may not represent the college student body. Although natural micromovements were limited in the present study, future studies should compare structured stretching interventions with naturalistic movement patterns to better capture real-world conditions while maintaining experimental control. Furthermore, the experiment could be improved by considering the impact of different stretching durations and break types compare with stretching in reducing discomfort and mental workload associated with prolonged sitting in academic settings.

CONCLUSION

Increased sedentary time among college students is an emerging concern. The results showed that taking stretching breaks from extended academic activities like classroom lectures or personal studying can potentially reduce discomfort and mental workload among students. Interestingly, unlike other ergonomic interventions like adjustable desks and chairs, stretching exercises are highly cost-effective and practical in academic settings with constrained spaces like classrooms. The findings could inform the integration of stretching breaks in classrooms to create a comfortable and mentally supportive learning environment required to improve student outcomes.

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