



Modifying the University Classroom to Increase Energy Expenditure in College Students

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ABSTRACT

The purpose of the present study is to determine whether energy expenditure can be increased by modifying a traditional-seated learning environment into a standing/activity permissive environment in college students. We hypothesize that students in a standing/activity permissive classroom setting will expend more daily caloric energy compared to a traditional-seated classroom. Support of this hypothesis may provide the rationale to transform learning environments from sedentary to a more activity-driven. The importance of this study is in response to the rise in obesity and how current interventions focusing primarily on diet and purposeful exercise, have not been able to counteract rising obesity rates. This topic needs to be further researched in order to increase the validity of this topic. Also, there has been little research investigating whether modifying the college classroom setting to an activity permissive environment is useful to enhance learning. In the present study, participants were fitted with physical activity monitors during two different classroom environments, a traditional/seated classroom and an activity permissive/standing classroom. Energy expenditure data was recorded for 60 minutes per day for 3 days over the course of two weeks. Activity monitors measured the participants' body movements and recorded caloric energy expenditure. Energy expenditure was significantly higher during the standing classroom environment compared to the sitting environment. The average sitting energy expenditure was ~18 kcal/h. compared with 31 kcal/h. Our study shows that modifying a traditional seated classroom environment into a more activity-permissive environment helps college students increase their daily energy expenditure. Increasing energy expenditure through NEAT may help to offset some of the health risks of sedentary behavior.

BACKGROUND

➤ Non-exercise Activity Thermogenesis (NEAT) is the energy expenditure resulting from any movement except purposeful exercise. NEAT has a tremendous variance between individuals and has been shown to have an important role in the prevention of obesity.

➤ With an estimated two-thirds of Americans overweight and one-third obese, it appears that previous interventions focusing on diet and exercise may not be the best solution to our ever growing obesity epidemic.

➤ It was once considered that an individual may be “active” if they were to exercise for the recommended 30-60 minutes/day for 4-5 days in a week. However, it now appears that the amount of time exercising may not counteract the majority of the time spent sedentary.

➤ The average classroom consists of seated desks which limits the amount of movement for students. It has been shown that a typical high school student may sit for approximately 7-8 hours per day while in their learning environment.

➤ Accordingly, the purpose of the present study is to determine whether energy expenditure can be increased by modifying a traditional-seated classroom environment to a standing/activity permissive classroom environment in college students.

EXPERIMENTAL AIM

The purpose of the present study is to determine whether energy expenditure can be increased by modifying a traditional-seated classroom environment to a standing/activity permissive classroom environment in college students.

METHODS

Subjects

- Fifteen (11 female, 4 male) healthy, college-aged participants between the ages of 18 and 22.
- Participants were recruited from University of Wisconsin Eau Claire courses Kinesiology 308-Exercise Physiology and Biology 214-Human Anatomy & Physiology 1.
- The fifteen participants were separated into two participant cohorts observed throughout the study. One cohort consisted of nine (6 female, 3 male) participants from the Kinesiology 308-Exercise Physiology course. The second cohort consisted of six (5 female, 1 male) participants from the Biology 214-Human Anatomy & Physiology 1 course.
- All participants provided written informed consent according to the guidelines of the University of Wisconsin – Eau Claire.

Testing Procedures

- Body composition including height, weight, waist circumference, and body mass index (BMI) was assessed
- Body fat percentages were estimated using measurements obtained from standard sites.
- Auscultatory resting systolic and diastolic blood pressure were taken along with resting heart rate.

Activity Measurement

- Triaxial accelerometers (Philips Direct Life) were placed at the right hip of participants to measure physical activity.
- Measurements were recorded for a 1 hour class period.



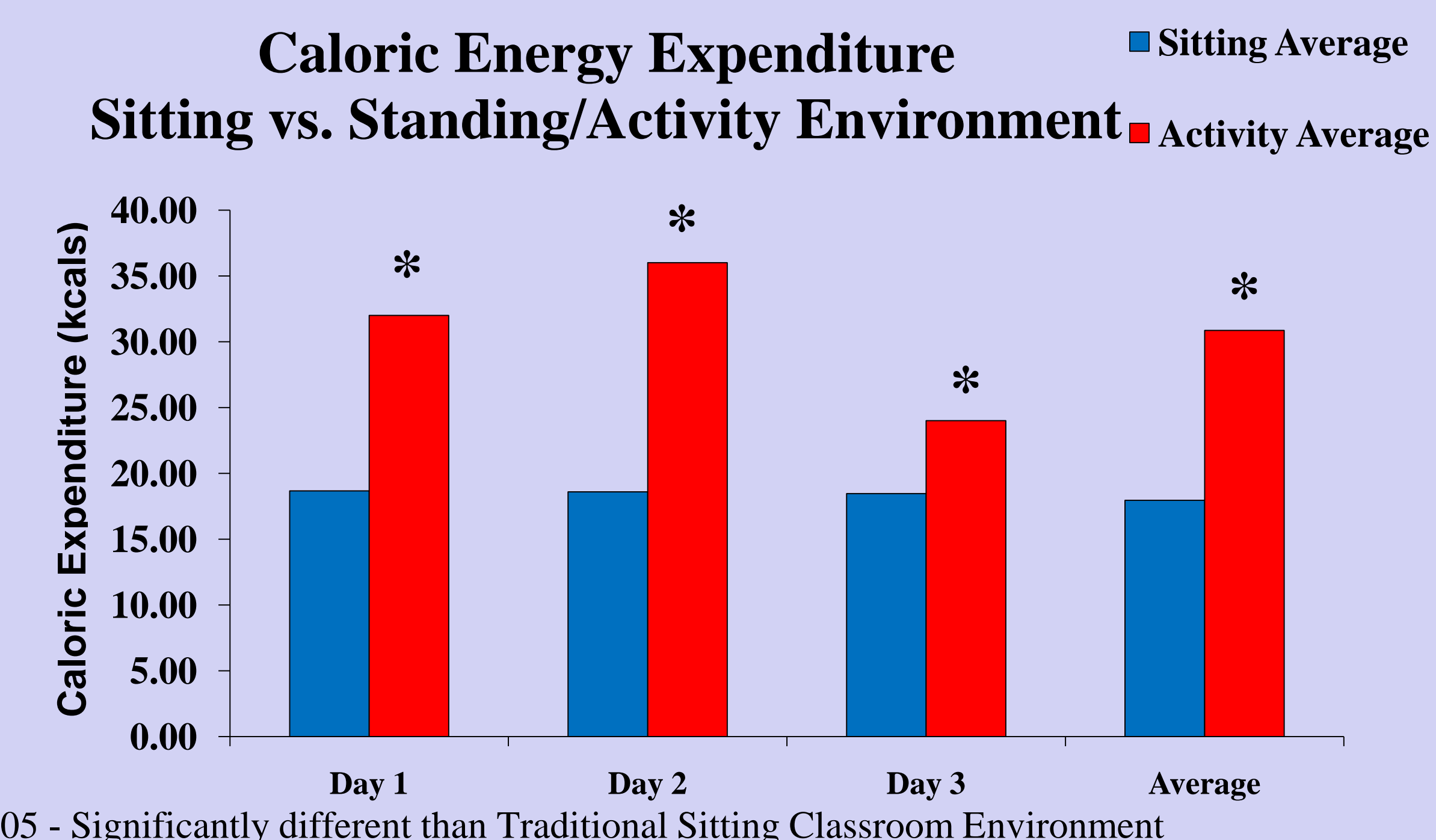
STATISTICAL ANALYSIS

The primary dependent variables were kilocalories expended. The independent variables were sitting or standing. Subject characteristic data was analyzed by descriptive statistics. Differences in energy expenditure between the traditional seated classroom trial and the standing, activity permissive classroom trial were analyzed by Paired T test. Data are presented as mean ± SD. Statistical analyses were performed using SPSS software version 17.0 (SPSS Inc). Statistical significance was set at P<0.05.

RESULTS

I. Subject Characteristics

Variable	Males	Females	Total Group
Age (years)	20.5 ± 1.30	19.45 ± 1.04	19.73 ± 1.16
Gender (M/F)	4	11	4:11
Height (m)	1.82 ± 0.05	1.60 ± 0.16	1.66 ± 0.17
Weight (kg)	79.43 ± 12.73	65.22 ± 10.08	69.01 ± 12.23
BMI (kg/m ²)	24.08 ± 3.77	25.85 ± 5.81	25.38 ± 5.28
Waist Circumference (m)	0.83 ± 0.09	0.78 ± 0.06	0.78 ± 0.07
Hip Circumference (m)	0.85 ± 0.10	0.95 ± 0.07	0.96 ± 0.07
Body Fat Percentage (%)	9.38 ± 3.04	24.09 ± 4.52	20.17 ± 7.87
Systolic Blood Pressure (mmHg)	116 ± 7	118 ± 4	118 ± 5
Diastolic Blood Pressure (mmHg)	78 ± 4	76 ± 2	77 ± 3



SUMMARY AND CONCLUSIONS

➤ The classroom environments and activity monitors were tolerated well by all participants.

➤ We found that energy expenditure increased significantly for participants in the standing/activity permissive environment.

➤ The mean (SD) sitting energy expenditure was 17.95 kcal/h. The mean standing/movement activity energy expenditure was 30.86 kcal/h. The mean increase in energy expenditure for standing/movement activity over sitting was 12.95 kcal/h.

➤ This study has shown that by changing the traditional classroom environment to promote activity, students may expend a higher amount of energy above sitting.

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