



A Study of an Accelerometer to Increase Energy Expenditure in Sedentary Individuals

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ABSTRACT

Purpose: The Gruve® accelerometer calculates daily energy expenditure and specifies a weekly energy expenditure goal that is specific to each individual. Using this information, we examined whether feedback from the Gruve® accelerometer can positively influence people to increase their weekly energy expenditure in the form of non-exercise activity thermogenesis. **Methods:** Seven apparently healthy adults (4 male, 3 female) between the ages of 30-61 years participated in this study. We performed a two week study comparing no-feedback (week 1) to feedback (week 2) and observed differences in energy expenditure for both weeks. **Results:** There were no significant differences in absolute weekly caloric expenditure between the use of the accelerometer without feedback (4692±910 kilocalories) compared with using the accelerometer while feedback was given (4856±1264 kilocalories). However, female subjects showed practical significance, as they increased their energy expenditure nearly 700 kilocalories from the first to the second week when informational feedback was provided from the accelerometer. **Conclusions:** The Gruve® accelerometer has potential to motivate people to increase their daily physical activity. It may be more effective in business settings for companies with sedentary employees to provide them with informational feedback on their energy expenditure goals, rather than for people who already have knowledge of their energy expenditure needs.

BACKGROUND

Despite the well-known beneficial effects of regular physical activity, only ~20% of adults in the United States habitually engage in the recommended amount of aerobic exercise required to improve cardiovascular health, while more than 37% are sedentary.

Non-exercise activity thermogenesis (NEAT) is the energy expenditure of all physical activities other than volitional sporting-like exercise. Increasing NEAT may help to enhance the energy expenditure goals of sedentary people.

Omni-directional accelerometers are popular motivational tools that measure intensity and duration of movement to estimate energy expenditure.

In particular, the Gruve® accelerometer takes into account a person's height, weight, blood pressure, waist circumference, percent body fat, and plasma levels of glucose and cholesterol to calculate a person's daily and weekly energy expenditure goal.

The Gruve® accelerometer also provides informational feedback regarding whether a person is meeting their daily energy expenditure goals.

This feedback may serve as an important behavioral modification tool because individuals are aware that their activity levels are being monitored. Therefore, wearing an accelerometer may actually help people increase their daily physical activity.

EXPERIMENTAL AIM

To determine whether feedback from the Gruve® accelerometer can positively influence people to increase their weekly energy expenditure in the form of NEAT.

METHODS

Subjects

Nine apparently healthy adults (5 male, 4 female) between the ages of 30-61 years participated in the study.

Volunteers were recruited from the University of Wisconsin- Eau Claire and surrounding community by personal contact.

All subjects provided written informed consent according to the guidelines of the University of Wisconsin – Eau Claire.

Screening and Testing Procedures

Body composition including height, weight and percent body fat.

Fasting blood chemistries including cholesterol and glucose.

Minimal waist circumference and body mass index (BMI).

Auscultatory resting systolic and diastolic blood pressure.

Primary outcome variable: weekly energy expenditure (kilocalories)

Gruve® Accelerometer

An accelerometer that provides a spectrum of five colors to indicate whether a person is meeting their daily energy expenditure goals.



Two Week Experimental Protocol

Week 1 – No feedback

Synchronization of accelerometer and computer program with participants' baseline data.

The Gruve® accelerometer was programmed to provide no feedback by disabling the five color changing halo and vibration.

Estimation of energy expenditure over one week without the influence of any feedback given from the accelerometer by wearing the device on right hip during all daily activities.

Week 2 – Informational Feedback

The Gruve® accelerometer was programmed to provide informational feedback in the form of the color changing halo.

Feedback was also provided by vibrating on the individual's hip when following a prolonged period of inactivity. Energy expenditure was measured throughout the second week.

Research participants were allowed to view their daily energy expenditure on the computer program as another form of informational feedback.

STATISTICAL ANALYSIS

Differences in baseline characteristics between male and female subjects were determined using independent sample T tests. A paired T test was used to assess differences in weekly and daily energy expenditure between the first week (no feedback) and second week (feedback) of the study. Statistical significance was set at $P < 0.05$. Data are represented as mean \pm SD. Statistical analyses were performed using SPSS software version 17.0 (SPSS Inc).

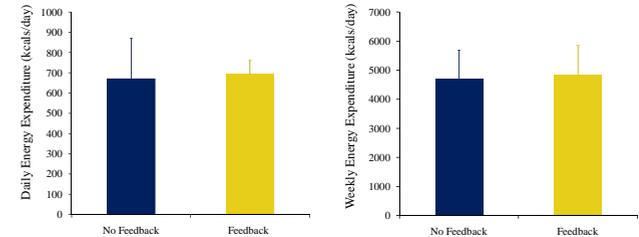
RESULTS

I. Subject Characteristics

Variable	Total Group (N=7)	Male (n=4)	Female (n=3)
Age (yr)	46.8±10.8	49.5±14.5	43.3±2.1
Height (m)	1.7±0.1	1.8±0.1	1.6±0.1
Weight (kg)	91.3±14.6	92.0±16.6	90.4±23.8
BMI (m·kg ⁻²)	31.5±7.5	28.6±2.0	35.8±10.6
Body Fat (%)	29.8±10.9	22.3±4.3	39.7±8.2*
Waist circumference (cm)	94.4±14.4	93.0±7.4	96.3±23.0
Fasting Glucose (mg·dL ⁻¹)	96.1±11.0	102.0±7.1	88.3±11.2
Total cholesterol (mg·dL ⁻¹)	162.0±29.7	145.6±22.9	184.3±23.7
High-density lipoprotein (mg·dL ⁻¹)	53.4±19.1	43.8±15.9	66.3±16.5
Low-density lipoprotein (mg·dL ⁻¹)	83.4±26.1	75.3±24.9	94.3±28.3
Triglycerides (mg·dL ⁻¹)	122.4±64.8	125.5±83.8	118.3±44.9
Systolic blood pressure (mmHg)	123±11	125±9	122±14
Diastolic blood pressure (mmHg)	79±3	79±3	79±3

*P<0.05 vs. male

II. There were no significant differences in absolute weekly caloric expenditure between the use of the accelerometer without feedback (4692±910 kcals) compared with using the accelerometer while feedback was given (4856±1264 kcals).



SUMMARY AND CONCLUSIONS

- In contrast to our hypothesis, providing informational feedback during the use of an omnidirectional accelerometer does not significantly improve energy expenditure over a two week interventional period compared to no feedback.
- Females with feedback from the device increased their energy expenditure ~100 kcals per day, representing an extra 700 kcals expended per week, which is considered practically applicable.
- The device seems best suited for sedentary individuals with minor knowledge pertaining to physical activity.

ACKNOWLEDGMENTS

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