

# Caloric Expenditure of Treadmill Running at 1% grade versus Outside Running

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## ABSTRACT

Quantifying the energy expenditure of physical activity is a very important tool to prescribe exercise in a variety of settings, from a home weight loss program to training elite endurance athletes. Aerobic exercise reduces the risk of pulmonary, cardiac, and metabolic diseases. In addition, recent research has shown that increasing energy expenditure through aerobic exercise is a good approach when designing exercise programs to optimize health benefits. One of the most common forms of aerobic exercise is running. The two most common modalities for running are using a treadmill or running outside. The question remains, does a difference in energy expenditure exist between these two modalities at similar pace? To address this question, we will examine energy expenditure in 9 healthy college age women and 6 men between a treadmill running protocol and an outdoor running protocol. We hypothesize that healthy young adult's experience an increase in energy expenditure during a session of outside running versus a session of treadmill running at a 1% grade. If we demonstrate support of our hypothesis, we would advise that individuals seeking greater energy expenditure and health benefits for a workout period of thirty minutes select outdoor running as their modality.

## BACKGROUND

➤Energy expenditure is the amount of kilocalories used during a particular activity.

➤Expending greater amount of energy through aerobic exercise has been shown to elicit important health benefits, and lower the risk of chronic disease.

➤Factors affecting energy expenditure may include intensity (grade, speed, etc.), environment (air pollution, weather, etc.), compression forces of running surface (pavement, running track, etc.), propelling the body, biomechanical changes, training status, and body composition.

➤Research shows that recruiting more muscle mass in an aerobic activity expends more calories compared to activities using less muscle mass. With respect to running, more muscles are recruited when running outside versus running on a treadmill.

➤Previous research has suggested that running on a treadmill at 1% grade accurately reflects the energy cost of flat outdoor overground running, but verification studies on this topic are limited.

➤Finding the most efficient way to burn calories in order to elicit weight loss and other health benefits can be useful information for a variety of people including trainers, coaches, etc.

➤Indeed, enhancing energy expenditure by adopting outside running as the preferred training modality over treadmill running may help exercise clients control body weight and obtain important health benefits.

## EXPERIMENTAL AIM AND HYPOTHESIS

To determine whether energy expenditure is different between 1% treadmill running and flat overground running of the same velocity in young healthy adults. We hypothesize energy expenditure will be greater while running on flat level ground outside compared with 1% treadmill running at the same velocity.

## METHODS

### Subjects

- Seven young adults (1 female, 6 male) between the ages of 20-24 years participated in the study.
- Volunteers were recruited from the University of Wisconsin- Eau Claire and surrounding community by personal contact and flyers.
- All subjects provided written informed consent according to the guidelines of the University of Wisconsin – Eau Claire.

### Screening and Testing Procedures

- Health history and physical activity questionnaire was completed
- Height, weight, resting heart rate, blood pressure, and BMI was assessed
- 1% grade at participants selected speed on treadmill to simulate over ground running
- Participants were paced outside using a Garmin 305 GPS and by a pace bike
- Each participant ran for 30 min outside and 30 min on treadmill on non-consecutive days

### Running Exercise Protocols

#### 30min Treadmill Running

- 1% grade @ individualized speed
- HR, RPE, RER
- portable oxygen; O<sub>2</sub>
- Woodway USA Treadmill

#### 30min Overground Running

- same selected speed
- HR, RPE, RER
- portable oxygen; O<sub>2</sub>
- Chippewa Valley Trail

- CosMed K4B<sup>2</sup> used to determine heart rate, oxygen consumption, and CO<sub>2</sub> production during each running session



## STATISTICAL ANALYSIS

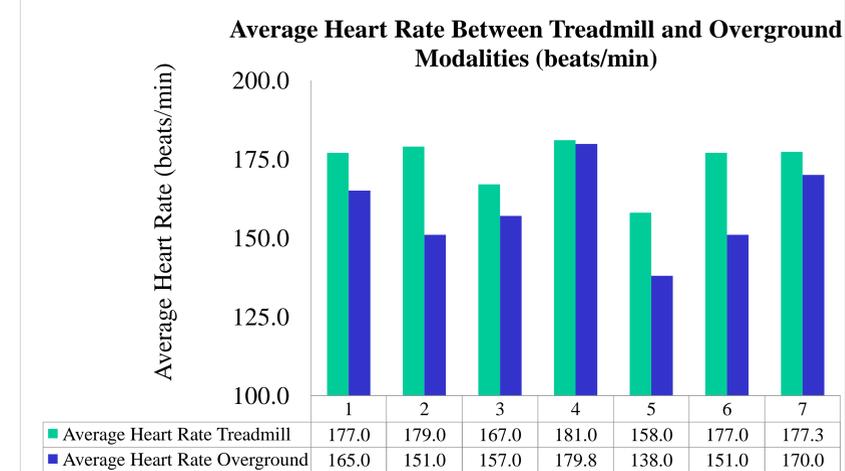
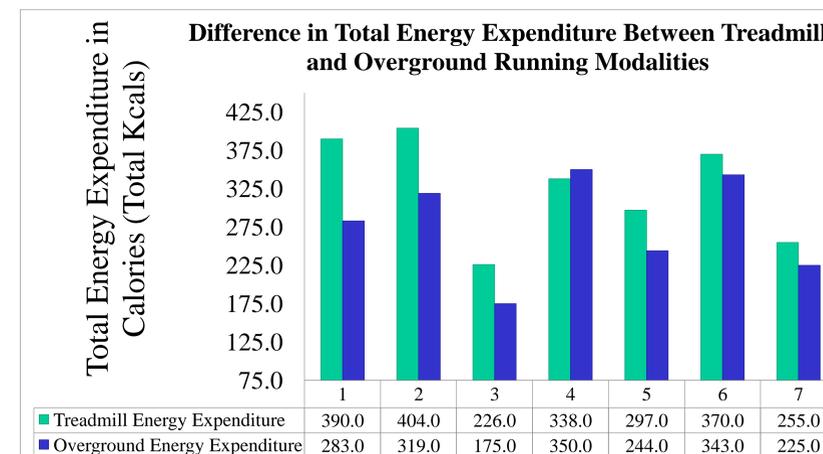
Subject characteristics were determined by descriptive statistics. Differences in energy expenditure between treadmill and overground running were determined by paired T tests. Data are presented as mean SD. Statistical analyses were performed using SPSS software version 17.0 (SPSS Inc). Statistical significance was set at P<0.05.

## RESULTS

### I. Subject Characteristics

Variable	Total Group N = 7
Age (years)	22.1±1.5
Gender	6 Male, 1 Female
Height (cm)	181.6±6.8
Weight (kg)	74.8±4.0
BMI (kg/m <sup>2</sup> )	23.0±1.7
Resting Heart Rate	58.4±2.6
Systolic Blood Pressure (mmHg)	120±7.2
Diastolic Blood Pressure (mmHg)	66.3±6.7

### II. Overall Energy Expenditure



## SUMMARY AND CONCLUSIONS

- Treadmill running at 1% grade elicits a higher heart rate response than an identical protocol over ground
- Subsequently, higher levels of energy expenditure were observed running on the treadmill at 1% grade
- At 1% grade on a treadmill, one will expend more calories at the same pace and distance than running outside on a paved and even ground
- Further research should be done to determine differences in 0% grade on a treadmill and overground running

## ACKNOWLEDGMENTS

We would like to thank all of the participants for volunteering in our study. We would also like to recognize the Department of Kinesiology and Dr. Don Bredle at the University of Wisconsin-Eau Claire for the use of equipment and supplies necessary to complete this study.