Analysis of Barefoot Running

This experiment is designed to investigate the effects of barefoot running, a running trend popularized by Christopher McDougall in the book *Born to Run*. Traditional running technique emphasizes a heel-to-toe foot strike during each stride. Without the padding provided by traditional running shoes, barefoot running tends to minimize heel strike. This often leads to a change in the step rate of the barefoot runner. Cadence is another word that is commonly used for step rate. Cadence is defined as the number of steps a subject takes per minute.

A pedometer is a device that can be used to monitor steps and step rate. As a result, a pedometer can be used to measure cadence when walking or running. The Go Direct Respiration Belt has a built in pedometer that will be used in this experiment. The Go Direct Respiration Belt will be attached to the subject who will run for a brief period of time while wearing normal running shoes. The subject will then repeat the test while running barefoot. The mean cadence in steps per minute (spm) will then be determined for both conditions. The subsequent data will be used to determine if barefoot running changes the cadence of the subject.

Important: The equipment used in this experiment is for educational purposes only and should not be used to diagnose medical conditions.

OBJECTIVES

- Use a Go Direct Respiration Belt to measure the cadence (spm) of a subject during normal running and barefoot running.
- Determine the subject's average cadence (spm) in each condition.
- Use the results to determine the effect of barefoot running on running cadence.

MATERIALS

Chromebook, computer, or mobile device
Graphical Analysis 4 app
Go Direct Respiration Belt
running shoes (to be worn by the subject)

PROCEDURE

Select one person from your lab group to be the subject. The subject needs to wear standard running shoes. **Important**: Do not volunteer to be the subject if physical exertion aggravates a health problem.

1. Connect and set up the sensor.

   a. Launch Graphical Analysis. Connect Go Direct Respiration Belt to your Chromebook, computer, or mobile device.

b. Click or tap Sensor Channels. Deselect the Force and Respiration Rate channels. Select the Steps and Step Rate channels.

c. Click or tap Done.

2. Click or tap Mode to open Data Collection Settings. Change End Collection to 60 s. Click or tap Done.

3. Place the respiration belt around the subject's waist. Tighten the belt until the tension indicator light, located in the bottom left corner of the sensor label, just below the check mark, turns green.

4. To zero the readings for the pedometer, click or tap the Steps meter and choose Zero. The reading for Steps should be close to zero.

5. Click or tap Collect to start data collection. Have the subject run at a moderate pace for 60 seconds. Data collection will end after 60 seconds.

6. Determine the average cadence when wearing running shoes.

a. Select the data from 10–60 s on the step rate *vs.* time graph.

b. Click or tap Graph Tools, ⬏, and choose View Statistics.

c. Record the mean step rate in Table 1, rounding to the nearest 0.01 spm.

d. Dismiss the Statistics box.

7. Have the subject remove the running shoes.

8. Repeat Steps 4–6 with the subject running barefoot at a moderate pace.

DATA

Table 1 Cadence	
Condition	Cadence (spm)
Running shoes	
Barefoot	

DATA ANALYSIS

1. What was the subject's cadence when running with running shoes? Did the subject's cadence change when running barefoot?

2. How did cadence for both conditions compare with other students in the group or class? Is this what you expected, and why?

EXTENSIONS

1. Repeat this study using different types of running shoes to determine if there is a difference in cadence associated with shoe type.

2. Determine if barefoot running produces a statistically significant change in cadence. Combine the data from the class and use a paired *t*-test to compare cadence when running barefoot to cadence when running with normal running shoes.

3. Determine if barefoot running produces a significant change in the running cadence of men and women. Use a paired *t*-test to compare the cadence of all the women in the class when running barefoot and with normal running shoes. Then use a paired *t*-test to compare the cadence of all the men in the class when running barefoot and then when running with normal running shoes.

4. Determine if barefoot running produces a statistically significant change in cadence for distance runners. Use a paired *t*-test to compare the cadence of distance runners in the class when running barefoot and with normal running shoes. Then use a paired *t*-test to compare the cadence of individuals in the class that are not distance runners when running barefoot and then when running with normal running shoes.

5. Design your own experiment to determine if barefoot running produces a statistically different change in cadence for different types of athletes.