driftline

A pilot-scale calorie study

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A pilot-scale calorie study by Driftline

Summary

A pilot-scale scientific study was carried out to test and measure a possible direct link between heart rate and calorie intake. The study was designed and supervised by the Icelandic health-tech company Driftline. The study hypothesis is based on measuring the thermogenic effect of food digestion on resting heart rate in humans. The study involved two separate trials with three volunteers each, to examine the hypothesis on a single meal-basis and on a continuous 24-hr tracking basis. The results of both trials provide support to the hypothesis and indicate that calorie intake can indeed be measured from heart rate. The accuracy of this approach appears to depend on the physical activity level of the individual. Driftline is presently developing a new and advanced approach of calorie tracking that does not require the tracking of resting heart rate and promises to be even more accurate. Driftline's recent discovery of endurance is the vital key to successful calorie tracking.

Methods

Tracking study.

This study involved continuous 24-hr tracking of heart rate and food intake by three volunteers, one male (36 years old, physically active) and two females (34 years old, physically active and 56 years old, physically inactive). Each participant kept a detailed dietary logbook, weighing and registering all consumed food over a period of 2-3 weeks, with a wide range in daily rations. All participants were instructed to engage in passive, sitting recovery as frequently as possible throughout the day.

Single meal study.

This study involved continuous 8–11-hour tracking of heart rate before and after consuming a single standardized meal. Three volunteers, one female (28 years old) and two males (26 and 55 years old) participated. The meals were standardized pasta meals of four different-sized rations, ranging from 500 to 2000 kcal per meal. All participants were instructed to ingest their meals as an afternoon meal during a period of less than 30 minutes and engaging in passive, sitting recovery for at least 8 hours after meal ingestion.

Heart rate was continuously monitored with Polar H7 chest straps and heart rate data downloaded into the Polar Beat app. Feed energy and composition was calculated based on the Icelandic Database on The Chemical Content of Food (ÍSGEM).

Results

The tracking study.

The tracking study was demanding on the participants, but they all managed to turn in a total of 10 – 17 whole recording days each. Calorie intake varied between 1000 – 3800 kcal per day by the females and between 1300 – 4600 kcal per day by the male. Two of the participants were physically active, engaging in physical exercise, such as running and weightlifting on approximately half of their recording days. One female did not engage in any physical exercise on any of her recording days. Figure 1 summarizes the results from the tracking study.

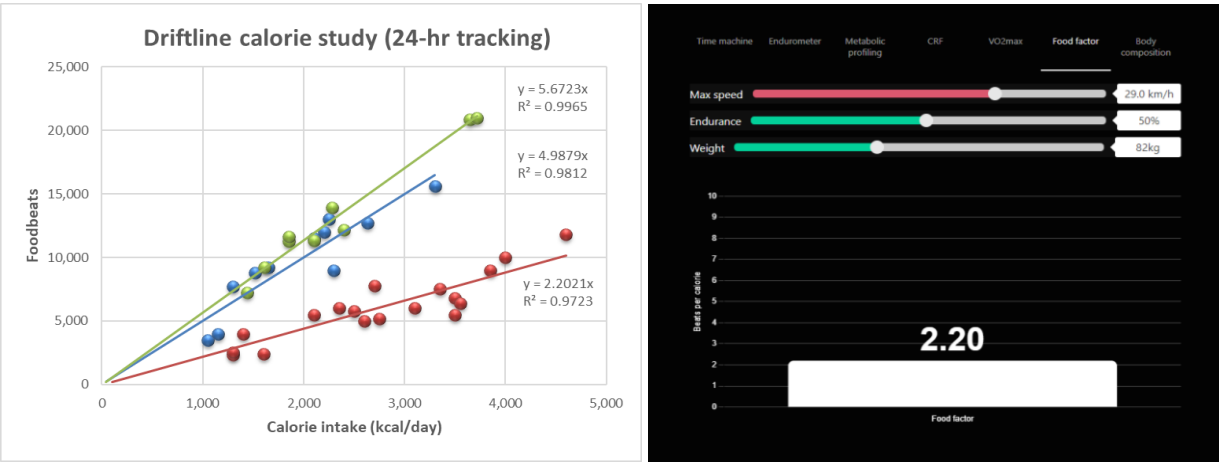

Figure 1. *a) Calculated food-beats vs calorie intake in the Driftline calorie tracking study. b) Calculated food-factor for the male participant by the Driftline biometric calculator.*

The recorded heart beats from each participant over each whole 24-hr recording session were divided into classes, based on the recorded heart rate, and eventually divided into three major classes, i.e., base-beats, activity-beats, and food-beats. The food-beats were assumed to be caused by the thermogenic effect of feeding. The analysis included a detailed correction for post-exercise-oxygen consumption (EPOC) and the corresponding heart rate response. Figure 1a shows the relationship between food-beats and calorie intake for each of the three participants. The slope of each regression line equals the food-factor for each participant i.e., 2.20 food-beats/kcal for the male (red dots), compared to 4.99 and 5.67 food-beats/kcal for the females. For the physically active participants (red and blue dots) the average deviation from the line was much larger than for the physically inactive participant (green dots). Figure 1b shows the calculated food-factor for the male participant (red dots) by the Driftline biometric calculator. A calculated food-factor of 2.20 food-beats/kcal agrees with the measured food-factor from the calorie tracking study.

The single meal study.

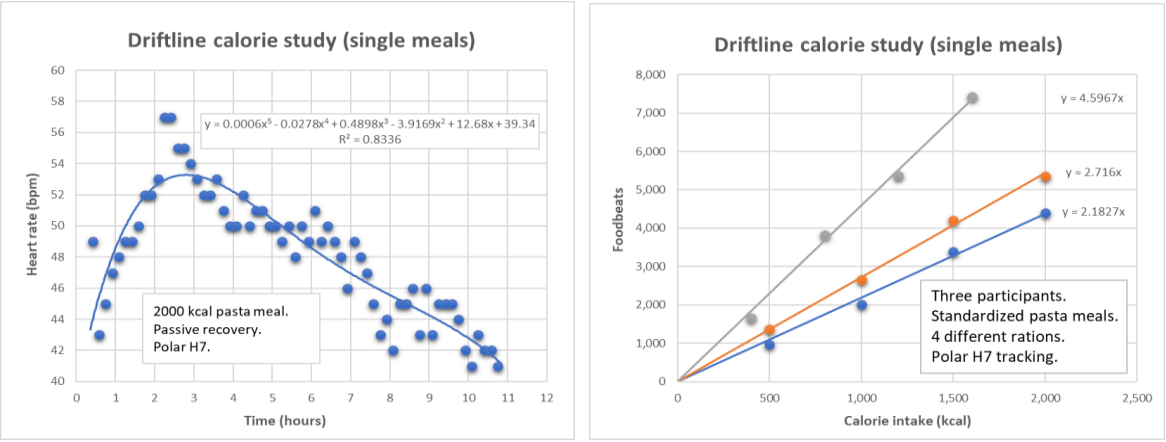

Figure 2. *a) The resting heart rate response by one male participant after ingesting a 2000 kcal standardized pasta meal in the Driftline single meal study. b) Calculated food-beats vs calorie intake by the three participants in the Driftline single meal study.*

Figure 2a shows the resting heart rate response by one male participant after ingesting a 2000 kcal standardized pasta meal and resting passively for 10-11 hours after meal ingestion. This large meal was ingested during 30 minutes at the start of the recording, and subsequently the resting heart rate increased steeply from about 43 bpm pre-ingestion to peek at around 57 bpm roughly 2 hours later. The resting heart rate then fell linearly back down to the pre-ingestion level during the next 7 hours or so. This positively skewed thermogenic heart rate response was fitted with a fifth order polynomial to calculate the accumulated total number of beats above the pre-ingestion base line, equaling 4400 beats in this particular case. Figure 2a shows the relationship between calorie intake and calculated food-beats from the four different-sized rations of each participant. The slope of each regression line equals the food-factor for each participant i.e., 2.18 and 2.72 food-beats/kcal for the males (red and blue dots), compared to 4.60 food-beats/kcal for the female (grey dots).

Discussion

The purpose of this pilot-scale study was to perform preliminary in-house testing of several hypotheses relating to potential heart rate-based calorie tracking. The results of the pilot study were very positive and provide support for the validity of the proposed methodology. It can be concluded that further, independent larger-scale scientific studies are indeed warranted. In summary, the following conclusions can be drawn from this pilot study:

- The thermogenic effect of feeding is reflected in the resting heart rate post-ingestion.
- Calorie intake is followed by a specific number of thermogenic heart beats (food-beats).
- The relationship between calorie intake and food-beats is presented by the food-factor.
- The food factor is strongly affected by gender, weight, max running speed, and endurance.
- Females have a much higher food factor than males.
- Physical exercise reduces the accuracy of this tracking method.
- The single-meal thermogenic effect increases linearly with the energy content of the meal.
- The thermogenic response from a large single meal can last for 9-11 hours post-ingestion.

Driftline is presently developing a new and advanced approach of calorie tracking that does not require the tracking of resting heart rate and promises to be even more accurate. This new approach analyses the individual food factor from heart rate analysis and uses 24-hr activity tracking to calculate calorie intake based on the balance between predicted activity heart rate and actual observed heart rate.

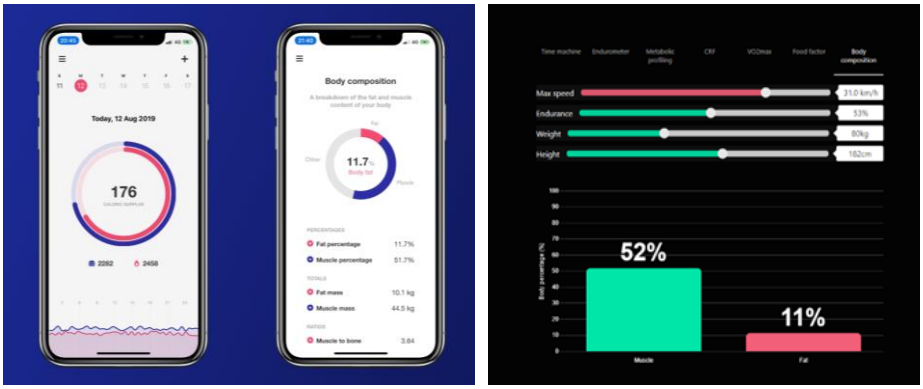

Figure 3. *a) Screenshots from the Driftline calorie tracking application. Calorie intake, expenditure, balance, body composition. b) Calculated body composition by the Driftline biometric calculator.*