HR wrist monitor

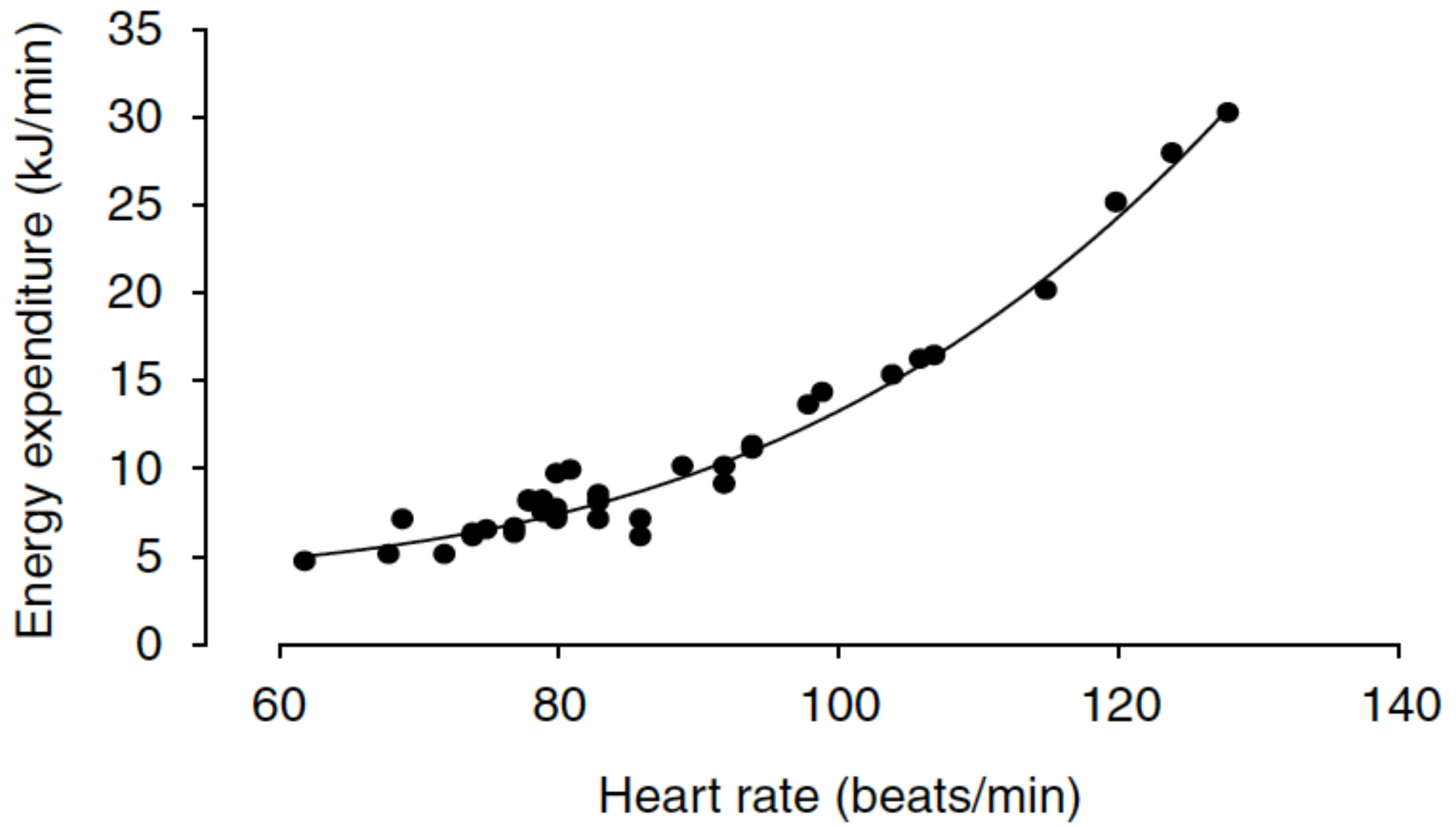


Fig. 2. The relationship between heart rate and energy expenditure in a healthy male study participant (unpublished data).

HR wrist monitor

HR measure issues

- HR <- environmental temperature and humidity, hydration status, posture, illness, stress, type of exercise (w/upper limbs or lower ones, continuous or intermittent), gender, age, body mass;
- w/≈3′ latency

but...

- pedometer/accelerometer -> level legged locomotion;
  no exercise with upper limbs, walking and running on soft ground or on slopes, cycling, swimming, rowing;
- pedometer/uniaxial accelerometer -> no over 9 km/h running

HR wrist monitor

HR measure issues

- (HR ≥ 90 bpm or ≥ 60% HRMax) ME = k HR;
- -30% daily ME;

(partial) answer:

- FLEX HR method (Spurr et al., 1988): ME = k HR (subject, activity specific) use only @external load/HR > FLEX HR, i.e., average between maximum value during rest or sedentary activity, and minimum value during light activity;
- i.e., (HR < FLEX HR) ME = rME, (HR > FLEX HR) ME = k HR;
- -17÷+20% daily DLW ME

HR wrist monitor

-> beat to beat recording -> HRV

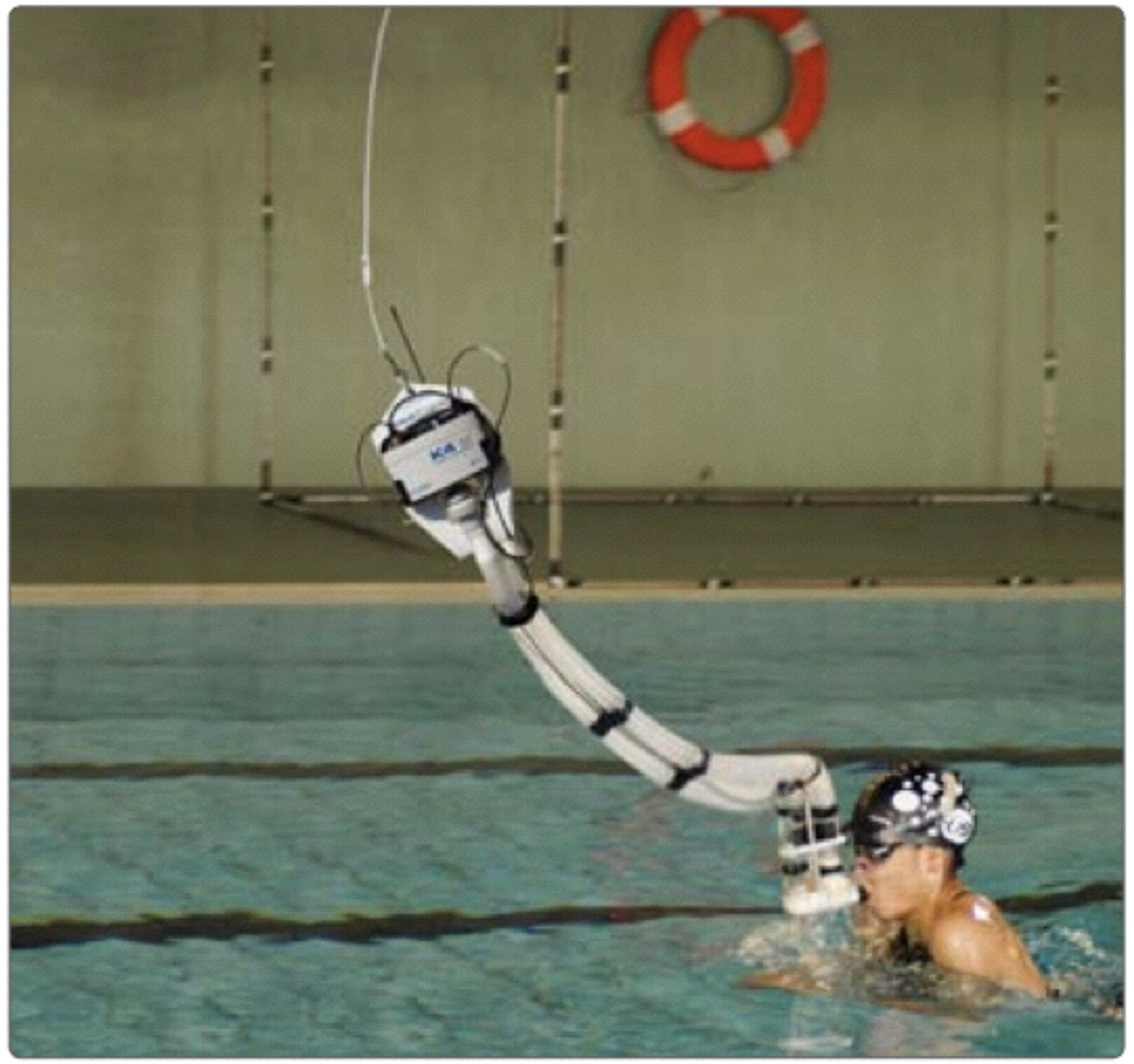
V'O2 measure

- direct calorimetry in metabolic chamber;
- indirect calorimetry, respirometry @closed/open circuit -> V'O2, V'CO2, …;
- < 8h

V'O2 measure

V'O2 measure

Option 1:
An operator can follow the swimmer by holding the K4b2 using a special rod (rod and harness are included in the standard packaging)



Option 2:
The K4b2 can be hung on a cable to be placed above the swimming pool lane

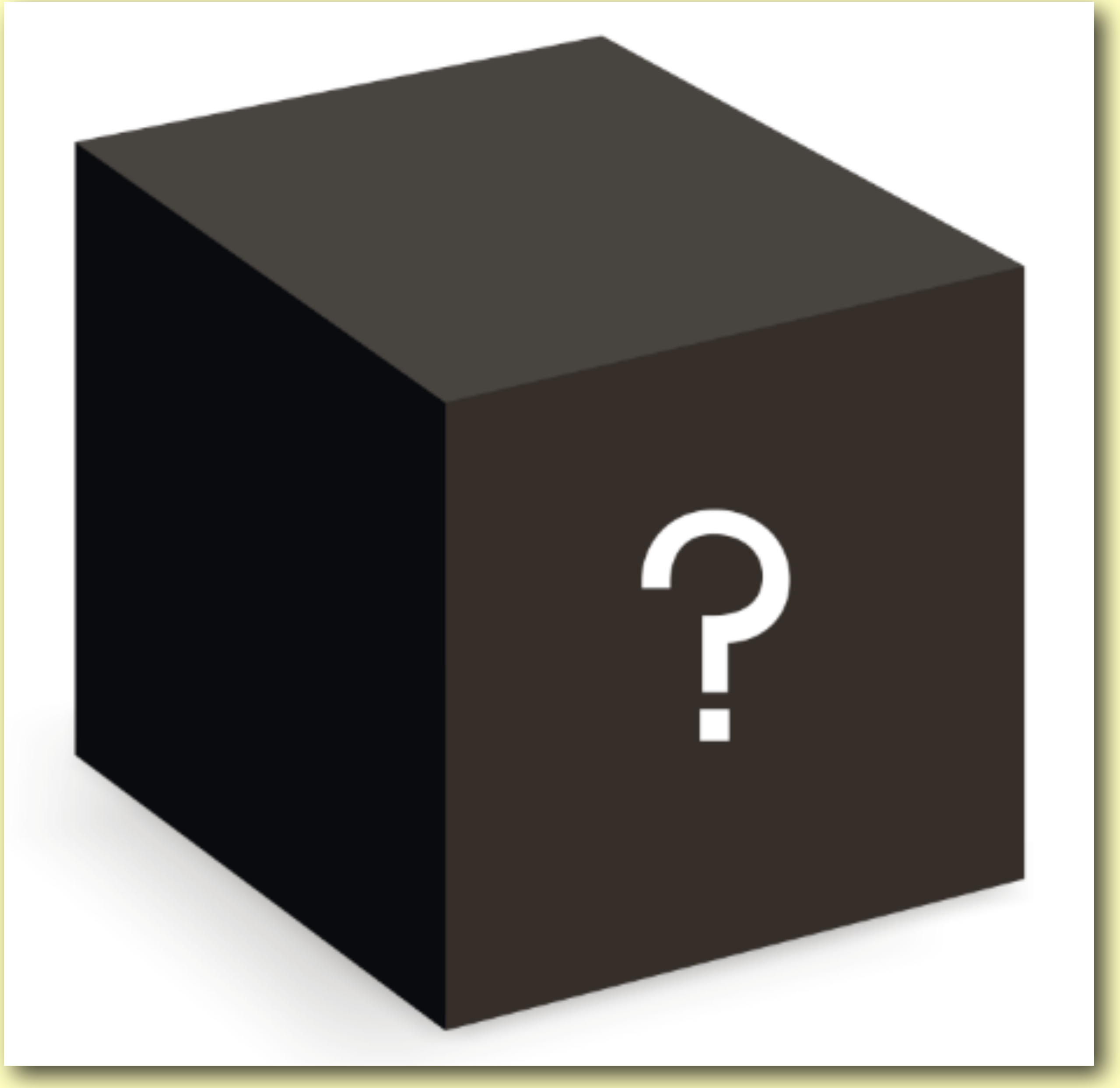
V'O2 measure

in originale, video, qui x ovvi motivi, rimosso

Accelerometer

Accelerometer issues

- PROPRIETARY ALGORITHM (i.e., “how from counts to ME?”);
- need for custom developed software…



Accelerometer

Accelerometer issues

- From linear to non-linear ME=f(counts) -> 3D accelerom. -50->-3% nME

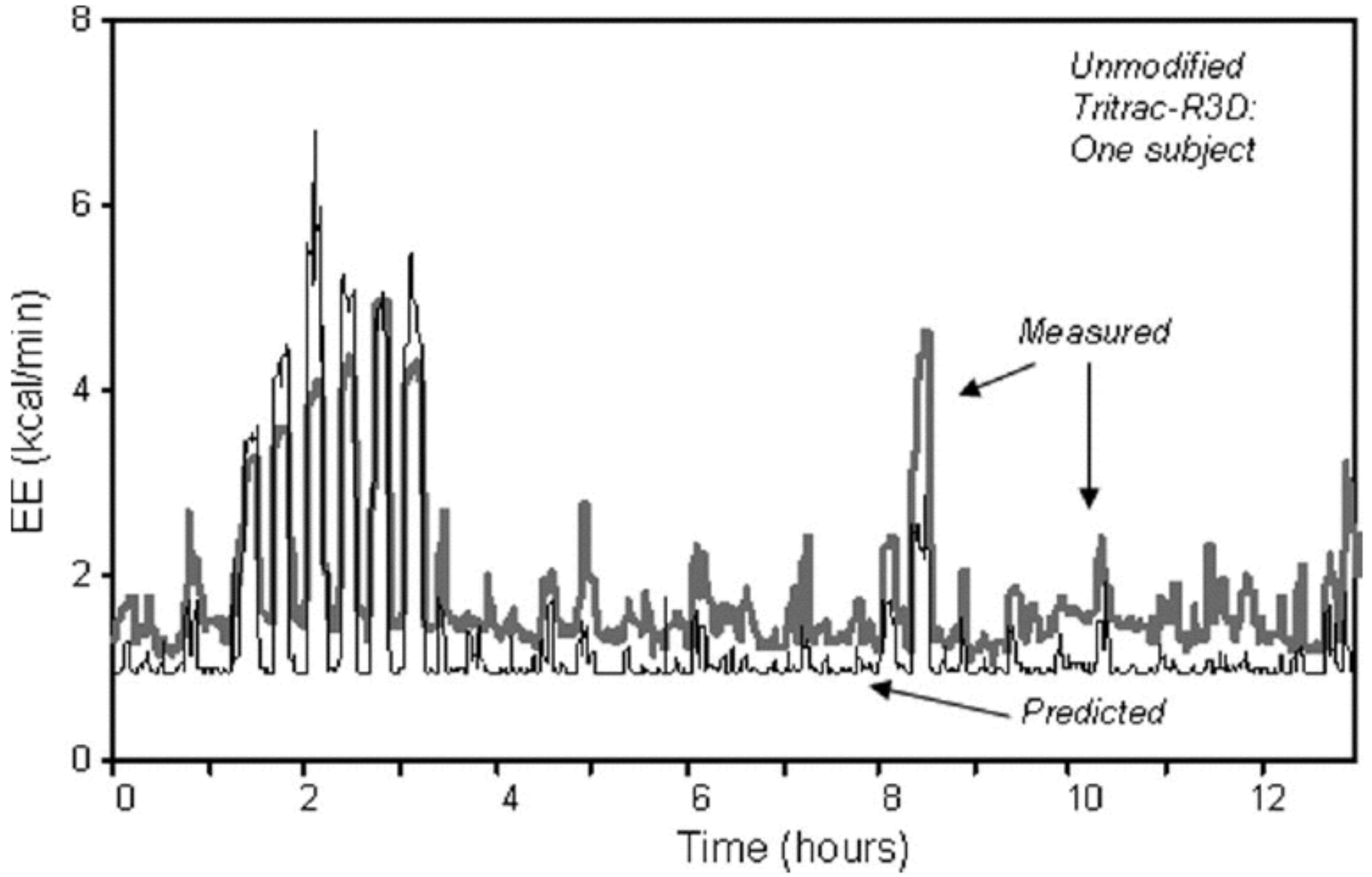


FIGURE 4—Subject: a woman age 32 yr, body mass 67.4 kg, resting EE = 1.06 kcal·min^{-1}. Tritrac-predicted EE (*thin black line*) vs the calorimeter-measured EE (*thick black line*) during the waking period of a 24-h stay in the room calorimeter. r = 0.88, SEE = 0.48 kcal·min^{-1}.

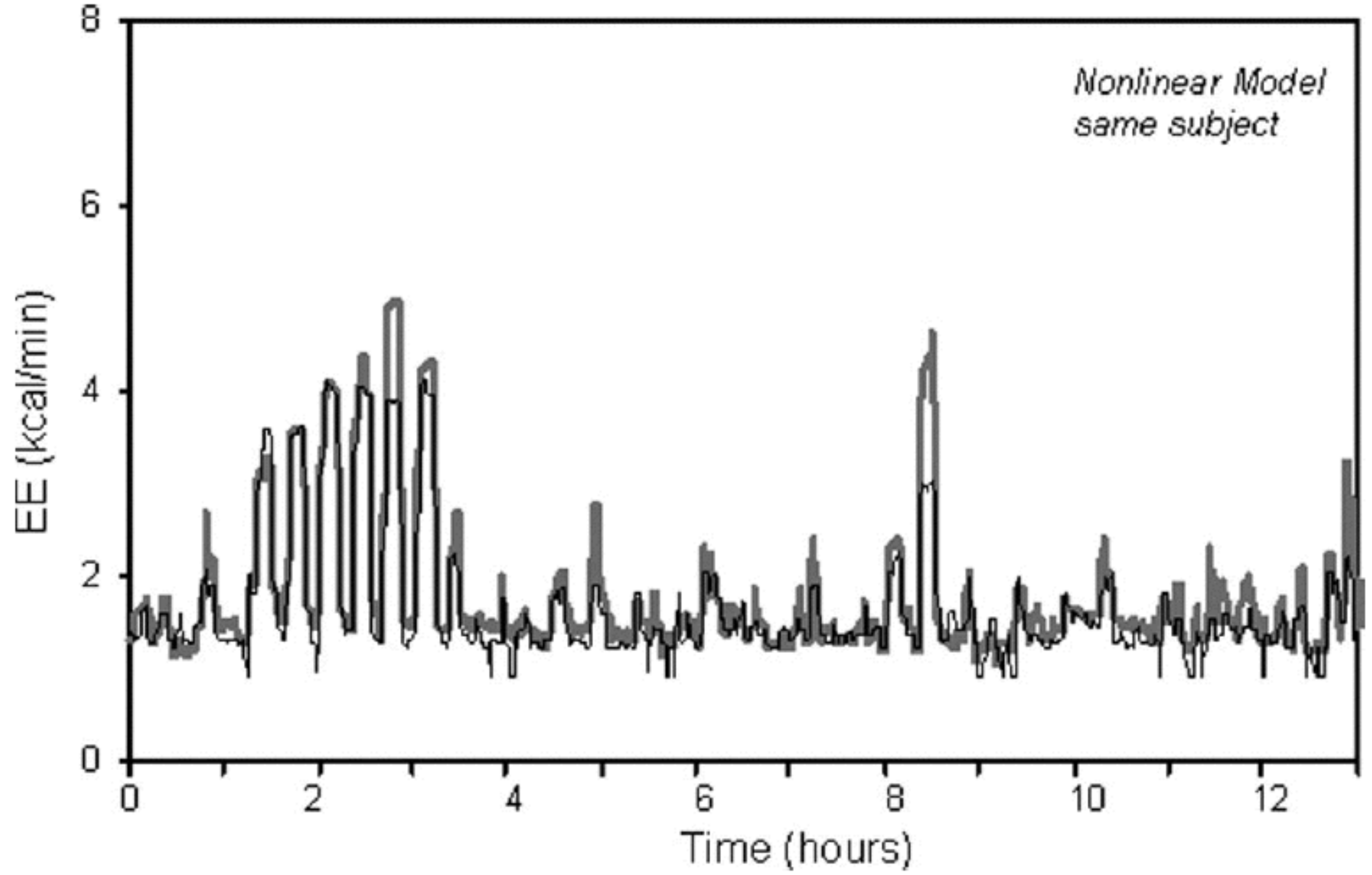


FIGURE 5—.Same subject as in Figure 4. Predicted EE using the modified two-component nonlinear model (*thin black line*) vs the calorimeter-measured EE (*thick black line*). r = 0.94, SEE = 0.27 kcal·min^{-1}.

Chen et al., 2005

Accelerometers

Caltrac  -> TriTrac-R3D -> RT3 

ActiGraph 71-64/-256  -> ActiGraph GT1M  ->

-> ActiGraph GT3X 

Accelerometers

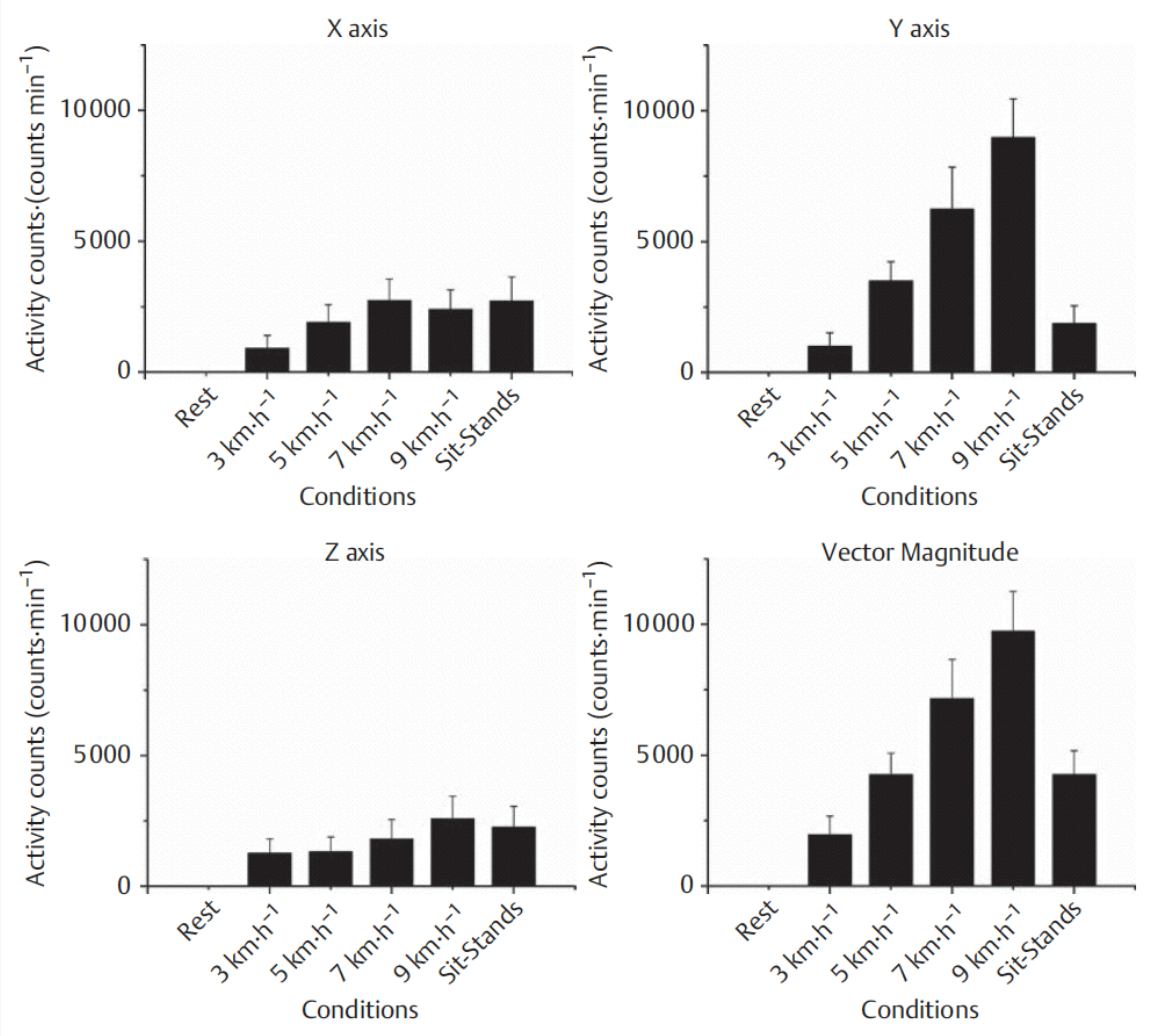


Fig. 1 Activity counts (counts · min^{-1}) (mean ± standard deviation) per axis and activities for all participants.

Santos-Lozano et al., 2013

Accelerometers

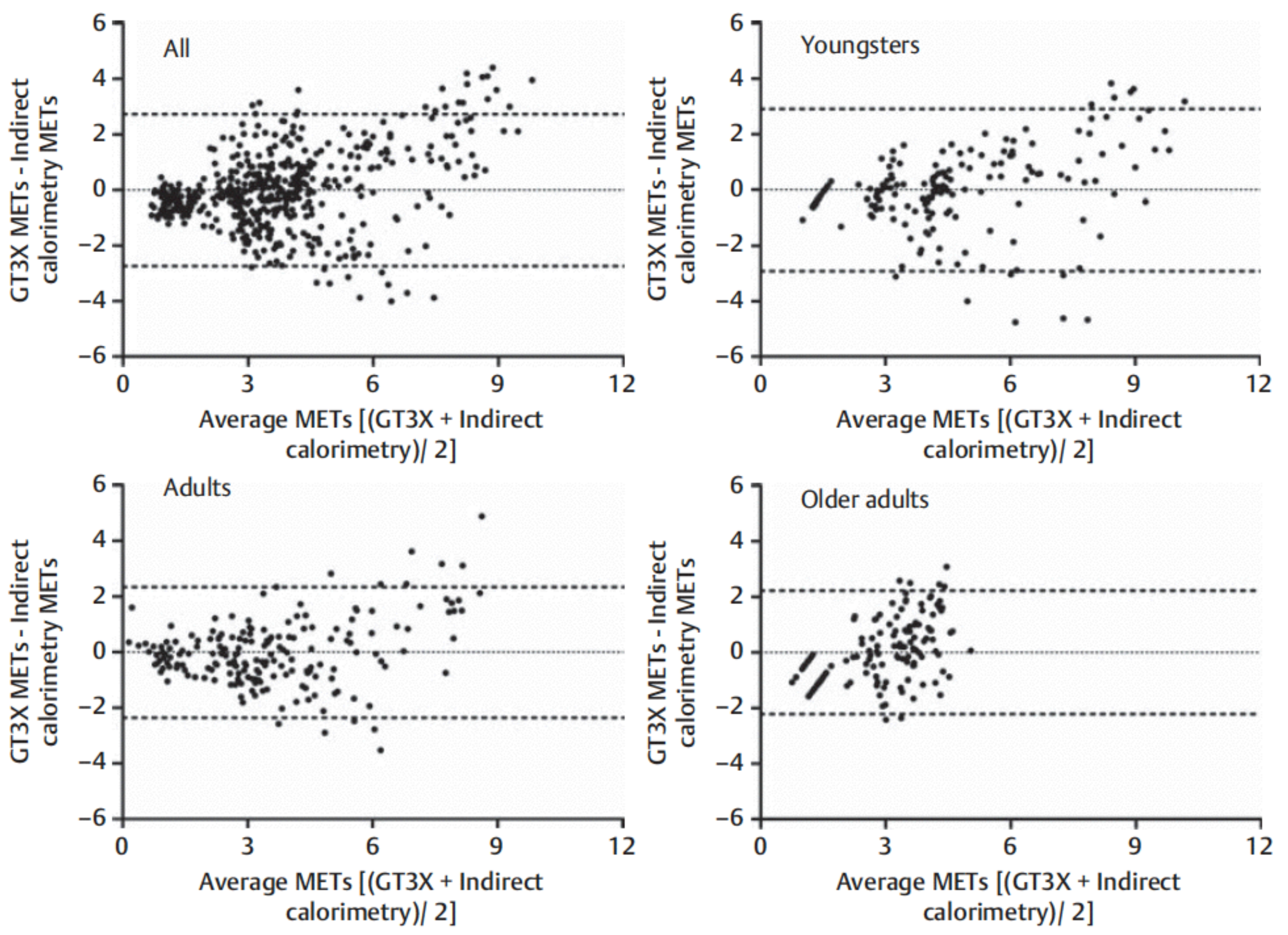


Fig. 3 Bland and Altman Plots in each group (energy expenditure (EE, in METs) determined with indirect calorimetry – EE (METs) predicted with GT3X).

Santos-Lozano et al., 2013

Accelerometers

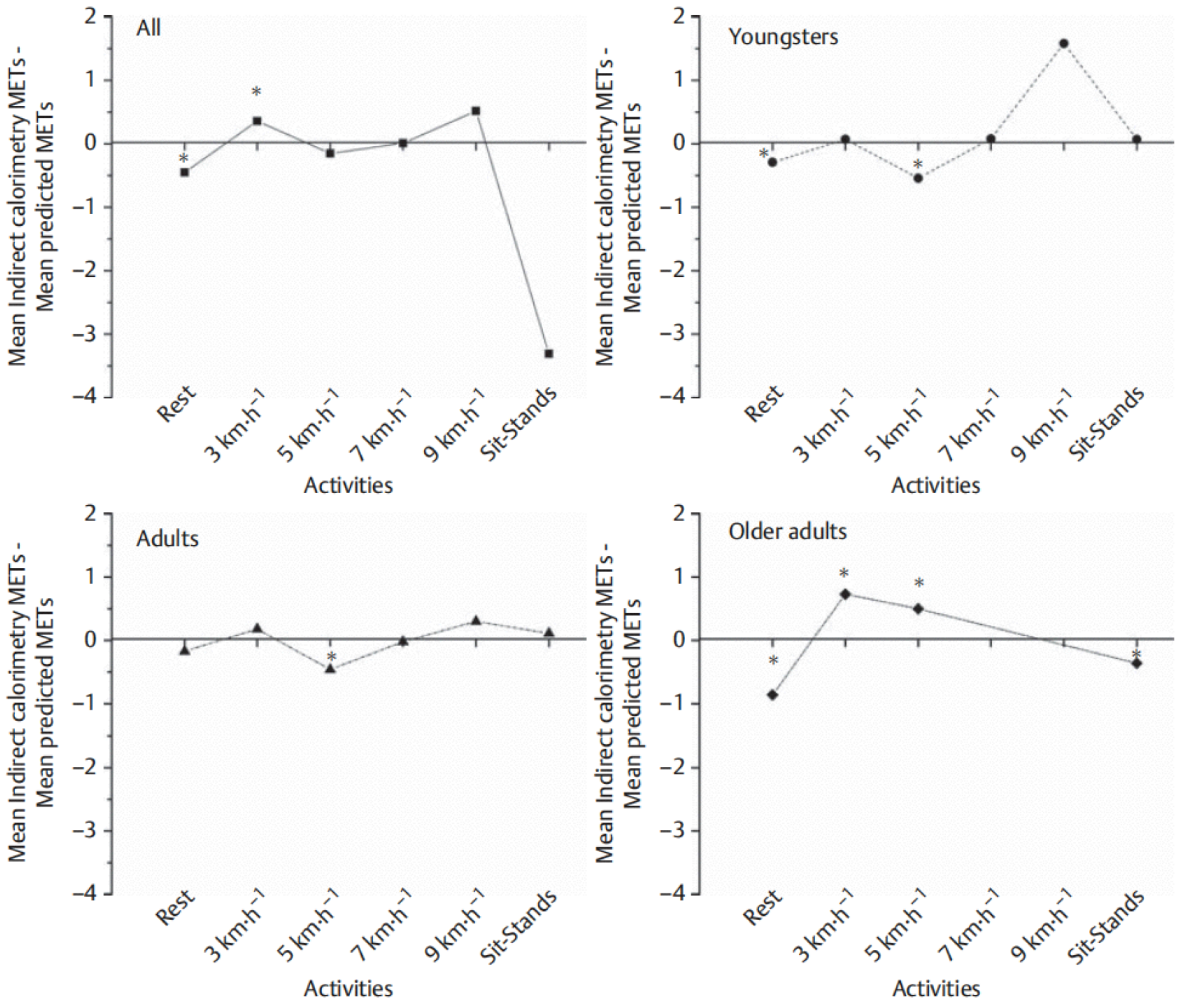


Fig. 4 Energy expenditure (EE, in METs) from indirect calorimetry vs. EE predicted with the GT3X for each age-group. *Significantly different from indirect calorimetry vs. predicted, same activity and age-group, $P<0.05$.

Santos-Lozano et al., 2013