Table A1. Comparison of indirect calorimetry (IC) and stable isotope techniques: [1-13C]glycine +[15N]glycine method (DLAAM), 13C bicarbonate (13C-BM), doubly labelled water (DLWM) for measuring energy expenditure (selected features).\*

\*partly presented by Junghans P & Chwalibog A., 2001 [1a]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Features** | **IC (respiration technique)** | **DLAAM** | **13C-BM** | **DLWM** |
|  |  |  |  |  |
| Measured or  calculated  parameter | From respiration  O2 consumption  CO2, (CH4) production  N losses (urine) | After [1-13C]glycine +[15N]glycine bolus / infusion  13C kinetics (CO2 of breath) and 15N excretion (urine)  🡪 CO2 production | After NaH13CO3 bolus / infusion  13C kinetics (CO2 of breath, blood)  🡪 CO2 production | After a bolus of 2H218O  2H, 18O kinetics in urine, blood  🡪 CO2 production |
| Assumed  quantities | Eeq of O2, CO2 for fat, CHO, protein, … | Eeq of CO2, RQ  13C recovery derived from 15N recovery | Eeq of CO2, RQ  13C recovery | Eeq of CO2, RQ |
| Derived parameter | Different components of energy expenditure: RMR, DIT, (PA) | Energy expenditure,  TEE | Energy expenditure,  TEE | Energy expenditure,  TEE |
|  | RQ 🡪 fat/ CHO oxidation,  N 🡪 protein oxidation | Whole body protein turnover, protein synthesis | Body bicarbonate pool,  Body bicarbonate turnover | Body water pool 🡪 body fat,  Body water turnover,  Non-renal water loss |
| Complementary use of methods | IC + BM: 13C recovery 🡪 correction of nutrient oxidation;  Determination of RMR, DIT, (PA) | DLAAM + IC: exact determination of 13C recovery; | BM + IC: exact determination of 13C recovery;  TEE etc. (see column of DLWM) | DLWM + IC:  TEE – RMR – DIT = PA  TEE / RMR = PAL |
| Alternative use of methods | Energy expenditure under *controlled experimental conditions* 🡪 restriction of movement, loss of social contacts etc. by the measurement (chamber, hood, canopy, mask) | Energy expenditure under field conditions  🡪 *natural living conditions* | Energy expenditure under field conditions  🡪 *natural living conditions* | Energy expenditure under field conditions  🡪 *natural living conditions* |
| Availability of  - measuring results  - metabolic parameters | after few minutes  after few minutes | 13C: after few minutes  13C: after 3 to 36 hours  Bolus technique:  15N: after 48 to 96 hours  Priming technique:  15N: after 3 to 12 hours | after few minutes  after 3 to 12 hours | after hours to days  after days to weeks |
| Continuous measurement | Yes (minute-by-minute) | Only spot sampling needed  After a bolus: 7 – 10 samples, | Only spot sampling needed  After a bolus: 7 – 10 samples, | Only spot sampling needed  (at minimum: two samples) |
| Accuracy | Good | Acceptable to good | Acceptable to good | Good |
| Precision | Good to excellent | Good to excellent | Good to excellent | Good to excellent |
| Technical complexity | Fairly complex, skilled personnel required for evaluation and measurement | Lowly complex, no skilled personnel required for measurement (infrared spectroscopy) and evaluation | Lowly complex, no skilled personnel required for measurement (infrared spectroscopy) and evaluation | Fairly complex, skilled personnel required for measurement (mass spectrometry) and evaluation |
| Corrections needed | - Haldane correction,  - Changes of body pools | 13C recovery from 15N recovery | 13C recovery | Isotope fractionations,  2H, 18O dilution spaces |
| Transportable? | No (respiration chamber) | Yes | Yes | Yes |
| Cost | Expensive (Whole body respiration) | Low ([1-13C]glycine, infrared spectroscopy, [15N]glycine, emission spectroscopy/mass spectrometry) | Low (13C bicarbonate,  infrared spectroscopy) | Expensive (18O water, mass spectrometry) |
| Safety? | Yes | Yes (non-radioactive) | Yes (non-radioactive) | Yes (non-radioactive) |
| Non-invasive? | Yes | Yes (*humans:* oral dosing possible) | Yes (*humans:* oral dosing possible, but 13C losses by eructation, if test subject do not cooperate, e.g. children, eldery, sick; animals ) | Yes (oral dosing, urine specimens) |
| Intrusive? | Yes (Chamber, hood, mask) | No (breath, urine, free-living conditions) | No (breath, free-living conditions) | No (urine, free-living conditions) |
| Acceptability, convenience for the subject | Adaptation required | Yes | Yes | Yes |

RMR. Resting metabolic rate, DIT: Dietary-induced thermogenesis, TEE: Total (daily) energy expenditure, PA: Physical activity, PAL: Physical activity level; Eeq: Energy equivalent, RQ: Respiratory quotient

Table A2. Comparison of 15N recovery (% of dose after administration of [15N]glycine in different studies.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Recovery  % of  15N dose | Time | End product | Number of subjects | Additional information | References |
|  |  |  |  |  |  |
| 34.9 | 96 h | Total urinary N | n=1 |  | Main paper |
| 35.9 | 120 h |
| 36.4 | 150 h |
| 36.3 | 96 h | Total urinary N | n=1 |  | [2a] |
| 34.5±1.6 | 96 h | Total urinary N | n=5 |  | [3a]. |
| 30.4±3.1 | 96 h | Total urinary N | n=5 | May, Start of expedition | [4a] |
| 26.4±1.6 | Total urinary N | n=3 | polar night |
| 30.3±2.1 | Total urinary N | n=3 | polar summer |
| 33.9±2.7 | 44-64 h | Urinary urea N | n=3 |  | |  |  |  |  | | --- | --- | --- | --- | | [28] |  |  |  | |
| 29.0±2.5 | 60 h | Urinary urea N | n=5 | diet 1.5 g prot d-1kg-1 | [39] |
| 30.9±2.7 | 60 h | Urinary urea N | n=5 | A modification of the Picou and Taylor-Roberts model was used | |  | | --- | | [40] | |