Measure or estimate energy expenditure in paediatric patients with spinal cord injury patients? A comparison of indirect calorimetry and commonly used predictive equations

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Introduction
Little is known about the energy expenditure after spinal cord injury (SCI). The accurate estimate of energy expenditure is crucial to avoid under- and over-feeding. Commonly used predictive equations tend to overestimate resting metabolic rate (RMR) by 3-32%\(^1\).
Indirect calorimeter (IC) is recommended as the reference standard for determining RMR.
This study aims to assess the accuracy of commonly used equations in paediatric patients with SCI.

Aims
1. Reported measured RMR (m-RMR) using QUARK indirect calorimeter.
2. Compare the m-RMR with estimated RMR (e-RMR) using predictive equations.
   - Harris-Benedict equation\(^2\)
   - Milfin-St. Jeor equation\(^3\)
   - Oxford-Henry equation\(^4\)
   - Schofield equation\(^5\)

Methods
Subjects had their 15mins RMR measured using QUARK indirect calorimeter after 3 hours fasting during October 2014 to August 2015.
Baseline demographic and clinical data included age, cause, level and date of onset of SCI and body mass index (BMI).

Analysis
Descriptive statistics were used to calculate the response frequency and proportions; Differences in frequencies between groups were tested with the chi-square test. The Mann-Whitney test was used to test for differences of ordinal data between groups.

Results
16 subjects were studied. Mean age 12, range 3-18 years, median BMI: 19.4; onset of SCI: 1249 days, 43% tetraplegia, 25% AIS: A.

Overall comparison
Three predictive equations were found to be over-estimated m-RMR by 12.2 to 31.5%.

Harris-Benedict: 31.5%, p=0.014
Milfin-St. Jeor: 12.2%, p=0.126
Oxford-Henry: 27.9%, p=0.028
Schofield: 27.4%, p=0.011

Sub-group analysis
No significant difference was observed when comparing onset of SCI (p=0.834).
No significant difference was observed when comparing tetraplegic and paraplegic group. (p=0.748)
No significant difference was observed when comparing m-RMR and e-RMR in both tetraplegic and paraplegic group.
All 4 predictive equations were overestimated RMR in tetraplegic group by 7.8 to 28.7% and in paraplegic group by 32.3 to 43.5%.

Discussion and Conclusion
Predictive equations could be used to estimate RMR in able-bodied population but it tends to overestimate in SCI patients.
The use of indirect calorimeter is an important tool for RMR measurement in SCI patients.
Predictive equations should be interpreted carefully in SCI patients.
Milfin-St-Jeor equation may be better predict RMR in SCI patients.
Children with SCI who are obese should consider to have their RMR measured via indirect calorimeter.

Possible further research
Given the limited sample size, further RMR study with a larger sample size is warranted.
Development of a validated SCI-specific RMR equation is warranted.

References: