CCP VALIDATION OF BODY COMPOSITION MODEL FOR ADULT MOUSE FOR IMPC

Pajuelo Reguera David, Sain Rajasree, Prochazka Jan, Rozman Jan, Sedlacek Radislav

Metabolism Unit, Phenotyping Module, Czech Centre for Phenogenomics, IMG, Czech Academy of Sciences, Czech Republic

Background

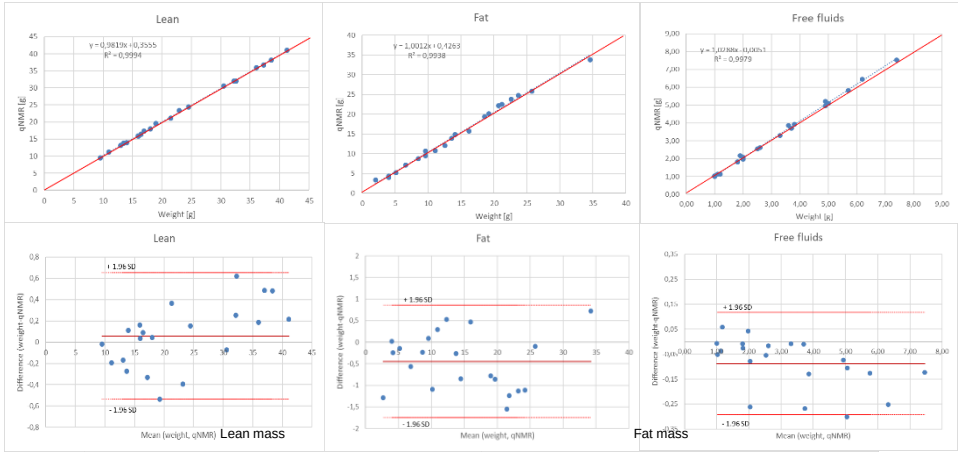
In vivo body composition analysis is an important and effective tool both in early and late adult phenotyping in IMPC to detect genes involved in energy balance regulation and the development of lean or obese phenotypes when fed a chow diet. We evaluated the performance of equipment based on quantitative Nuclear Magnetic Resonance (qNMR), the Minispec LF90ii (Bruker). qNMR allows measuring body composition quickly, non-invasively, and without anesthesia. Implementing qNMR significantly reduces experimental burdens improving animal welfare. qNMR is a high-throughput method and suitable for longitudinal studies.

Methods

The calibration procedure of the instrument was based on a model using chicken breast, lard, and 0.9% saline solution. Chicken breast, from which all fat was carefully removed, was used as surrogate for lean mass. Unprocessed lard was used to model fat mass and saline solution for free fluids. With these components, a standard 45-point standard curve was generated with exactly known quantities for each tissue type for every standard sample. These measurements are only necessary once to generate the calibration model. After implementing the calibration model, we validated the model using 21 C57BL/6N mice of different age and sex.

Results

Correlating qNMR results and the component masses of the standard samples showed a high match between methods. For lean mass, the R^2 was 0.9994. For fat mass, 0.9938, and for free fluids, 0.9979. Bland-Altman plots indicated only small inconsistencies or systematic methodological differences. The results also show the average of duplicate measurements of 21 mice in a regression plot as a function of total body weight. For all three parameters, data correlate very well, and slopes and y-intercept were very close to 1 respectively 0. Finally, we show a plot with a compilation of more than 90 wildtype mice per sex from IMPC cohorts measured with this model.



Conclusions

We aimed to implement a body composition analysis method that provides data that is close to the energetically relevant component masses. Both fat and lean mass determined by qNMR were in the range of chemical carcass analysis (N. Ehrhardt, unpublished data). There is good indication that our calibration approach is suitable for body composition analysis in IMPC.

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