

Reference Ranges for Human Body Composition and Fluid Overload

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BACKGROUND

- Determination of human body composition and fluid overload (FO) is of major importance in the therapy of patients with CKD.
- Studies show that whole body bioimpedance spectroscopy (BCM – Body Composition Monitor) can be used for an accurate and objective assessment of body composition and fluid status.
- Reference ranges (normal ranges) are essential to facilitate the clinical interpretation of the measured body composition and fluid overload.

AIMS

- Derivation of normal body composition ranges in a healthy paediatric and adult population.

SUBJECTS AND METHODS

- BCM Bioimpedance measurements from 2071 healthy Caucasian subjects (307 boys, 300 girls, 680 males, and 784 females) aged 2 – 95 years
- Determination of fluid overload FO and body composition in terms of extra- and intracellular water (ECW, ICW) and lean and fat tissue
- Normalization of lean and fat tissue:
 - Lean Tissue Index: $LTI = \text{Lean Tissue Mass} / \text{Height}^2$
 - Fat Tissue Index: $FTI = \text{Adipose Tissue Mass} / \text{Height}^2$
- Calculation of reference ranges by a percentile-based analysis of LTI, FTI, ECW/ICW ratio, absolute FO, and relative fluid overload ($RelFO = FO / ECW$)
- Normal ranges are separated for gender and age and compared with data available from the literature.

RESULTS

- Figures on the right side show reference ranges (data points, 10th and 90th percentile lines and polynomial fit) for the LTI, FTI, ECW/ICW ratio and the absolute and relative fluid overload in male and female subjects over age.
- Reference ranges for LTI, FTI and the ECW/ICW ratio are dependent on age and gender
- Reference ranges for absolute and relative fluid overload are independent of age and gender:
 - Absolute FO: $\pm 1.1 \text{ L}$
 - Relative fluid overload: $\pm 7 \%$

CONCLUSION

- Characteristics of the normal ranges calculated consistent with well known observations concerning the development of body composition during maturation and aging.
- Age and gender are essential inputs for calculating reference ranges in individual subjects.
- Improvement of the method to assess fluid and nutritional status

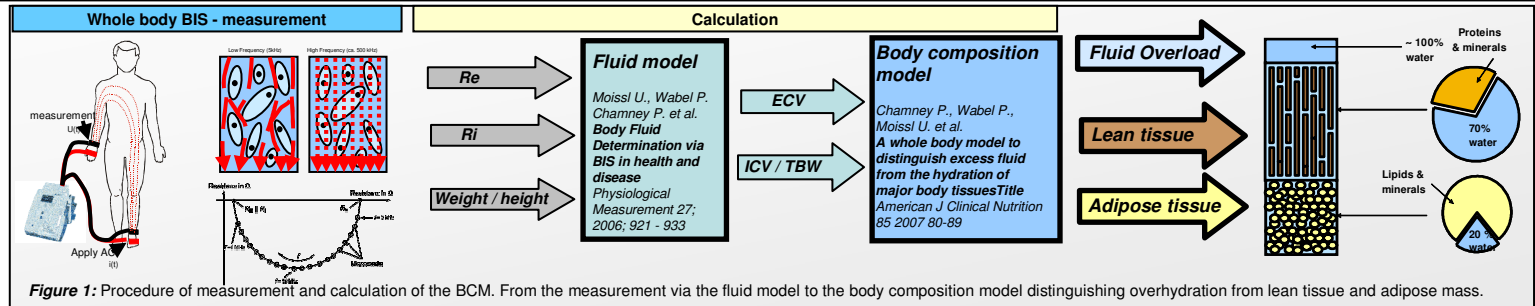
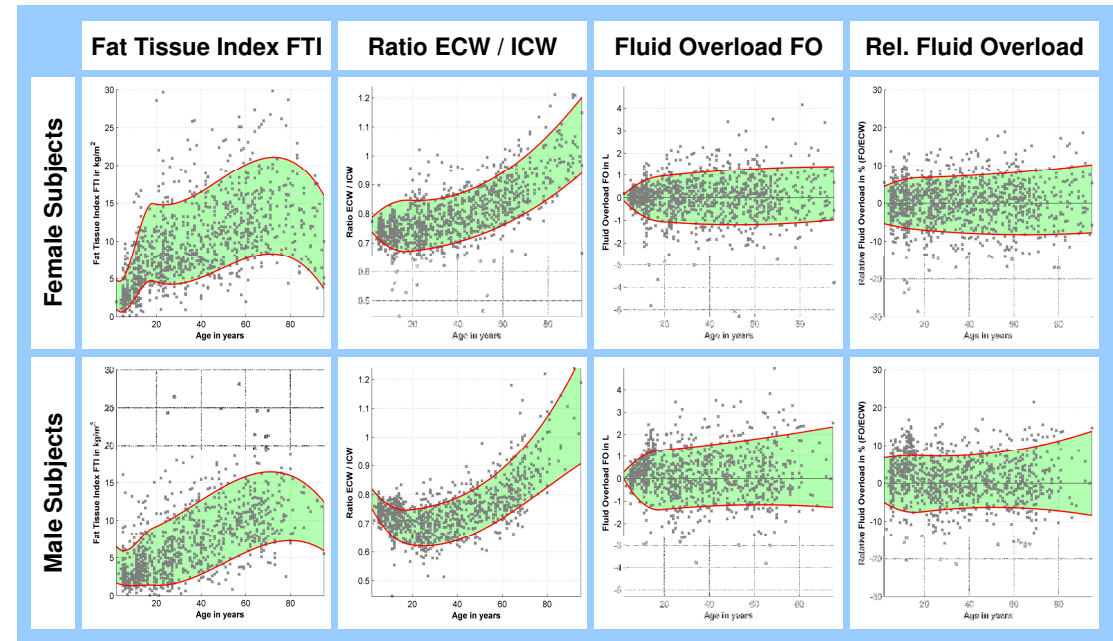
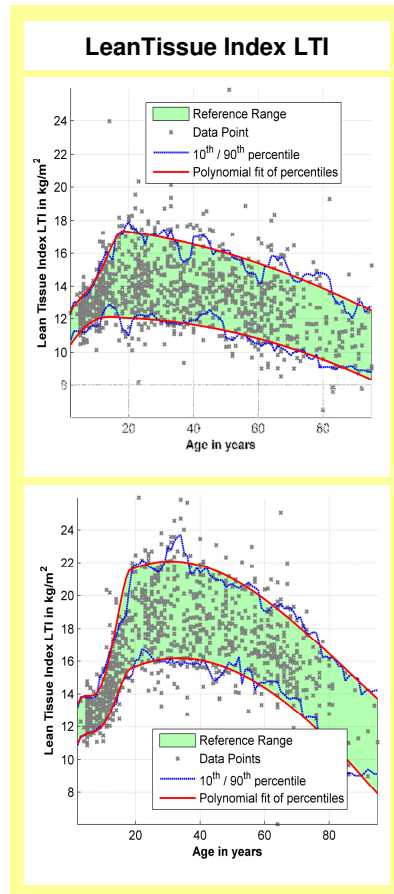


Figure 1: Procedure of measurement and calculation of the BCM. From the measurement via the fluid model to the body composition model distinguishing overhydration from lean tissue and adipose mass.



TAKE HOME MESSAGE

- Reference ranges offer a significant improvement in the evaluation of a single subject's body composition and fluid overload
- Assessment of fluid status and nutritional status at a glance

