Percent Body Fat: Estimation and Interpretation

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Overview

• Estimate percent body fat
  – Slaughter method
  – Gurka method

• Interpretation of percentages
Rationale

- Growth/nutritional status linked to health, participation, life expectancy in individuals with CP
- Due to differences in body composition, simple anthropometric measures used in other populations not predictive of nutritional status in individuals with CP (weight/height, BMI, arm circumference, single skinfold measurement)
- Complex methods of body composition assessment not always feasible in clinical setting (underwater weighing, D\textsubscript{2}O dilution, DEXA, BIA)
- Additive skinfold equations developed to predict percent body fat

Stevenson et al, 2006
Kuperminc et al, 2010
Brooks et al, 2012
Brooks et al, 2014
Triceps skinfold
Subscapular skinfold
Slaughter Equations

- Estimate percent body fat from skinfolds
- Prior equations by Lohman et al. not adequate for children (change in body composition over time and pubertal status)
- Developed from classic methods used to measure body composition (underwater weighing, D20 dilution method)

Slaughter et al, 1998
Gurka Equations

- Estimate percent body fat from skinfolds
- Slaughter equations underestimate percent body fat in children with CP
- Specific to individuals with CP
- Developed correction factors to Slaughter equations
- Based on DEXA
- Externally validated in ambulatory population
- May overestimate percent body fat in children with higher percent body fat
Two skinfolds: subscapular and triceps

1. Slaughter method to calculate percent body fat.

2. Correct for CP, gender, pubertal status, severity of motor impairment (GMFCS 3-5)
Example

- 11 year old prepubertal white male with CP GMFCS 4
- TSF=10
- SSF=11
Percent body fat by Slaughter method

- TSF=10, SSSF=11
- %BF Slaughter=1.21 (TSF+SSSF)-.008 (TSF+SSSF)^2-1.7
- %BF Slaughter=1.21 (21) – 0.008 (441) – 1.7
- %BF Slaughter= 25.42 – 3.528 - 1.7
- % BF Slaughter=23.6%
Percent Body Fat by Gurka Method

- % BF Gurka = % BF Slaughter (corrected)
  - CP +12.2
  - Male -5
  - Level of motor impairment +5.1

- % BF Gurka = 23.5 + 12.2 – 5 + 5.1

- % BF Gurka = 35.8%
Interpretation

- Published, population based reference curves are *descriptive* rather than *prescriptive*.
- Published, population based accepted cutoffs (may or may not be relevant to children/adolescents with CP) are *prescriptive*
  - Based on percentiles (random?)
  - Based on health indicators (outcomes, metabolic studies)
- Emerging health indicators in population of individuals with CP
  - Overall growth relationship with health and participation (Stevenson et al, 2006)
  - Body weight relationship with mortality (Brooks et al, 2012)
  - No published indicators linked to percent body fat in this population

McCarthy et al, 2006
Reference Curve
Percentiles for Percent Body Fat: US Boys Ages 5-19 NHANES IV

Laurson et al., 2011
Recommended cutoffs: UK Boys Ages 5-18

McCarthy et al, 2006
References


• Slaughter et al. Skinfold equations for estimation of body fatness in children and youth. Human Biology, 1984