**Prediction of fat-free mass and fat mass from bioimpedance spectroscopy and anthropometry: a validation study in 7- to 9-year-old Kuwaiti children**

**Legends to supplementary figures**

**Supplementary Figure 1**: Body fat percentage (%BF) predicted by different anthropometric algorithms compared to the reference method of deuterium dilution

Data are presented as limits of agreement plots [difference between methods (deuterium-derived reference – named prediction method} plotted against the deuterium reference values].

Key ⭘ Female participants

⚫ Male participants

**------------** Limits of agreement (± 1.96 SD)

Regression line

………….. Bias

**Supplementary Figure 2**: Total body water (L) predicted by different impedance algorithms compared to the reference method of deuterium dilution (D2O)

Data are presented as limits of agreement plots [difference between methods (deuterium-derived reference – named prediction method} plotted against the deuterium reference values].

Key ⭘ Female participants

⚫ Male participants

**------------** Limits of agreement (± 1.96 SD)

Regression line

………….. Bias

**Supplementary Figure 1**

**Supplementary Figure 2**

**Supplementary Table 1: Prediction equations for body density and %BF**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Reference | Sex  (n) | Age (years)  Mean or range | %BF | Ethnicity | Body densitya  (BD, kgL-1) | %BF |
| Durnin and Rahaman (26) | Male  (48) | 12.7 to 15.7 | 15.9  (5.4 to 34.7) | Caucasian  UK | 1.1533 - 0.0643 \* log SSF |  |
| Female  (38) | 13.2 to 16.4 | 24  (16.0 to 33.8) | 1.1369 - 0.0598 \* log SSF |  |
| Slaughter et al. (9) | Male  (50) | 9.8 | 20.4 to 8.2 | Mixed  (USA) |  | 1.21 \* SSF2 - 0.008 \* (SSF2)2 - 1-7 |
| Female  (16) | 10 | 24.4 to 6.8 |  | 1.33 \* SSF2 - 0.013 \* (SSF2)2 – 2.5 |
| Johnston et al. (30) | Male  (140) | 8 to14 | 16.5 ± 7.9 | Caucasian  (Canada) | 1.166 - 0.070 \* log SSF |  |
| Female  (168) | 22.6 ± 7.5 | 1.144 - 0.060 \* log SSF |  |
| Wendel et al. (27) | Male  (401) | 8.2 to 14.2 | 26.8  (22 to 31.9) | Mixed (Non-African)  (USA) |  | 12.74 \* log SSF − 21.47 \* ln Height + 87.82 |
| Female  (434) |  | 13.99 \* log SSF − 21.42 \* ln Height + 85.65 |
| Brook(31) | Male  (12) | 1 to11 | 23.7  (13.8 to 36.5) | Caucasian  (UK) | 1.1690 - 0.0788 \* log SSF |  |
| Female  (11) | 33.1  (23.5 to 38.0) | 1.2063 - 0.0630 \* log SSF |  |
| Deurenberg et al. (29) | Male  (114) | 7 to 20 | 11 | Caucasian  (Holland) | 1.1133 – 0.0561 \* log SSF + 1.7 \* Age \*10-3 |  |
| Female  (98) | 10.5 | 1.1187 – 0.0630 \* log SSF + 1.9 \* Age \*10-3 |  |
| Alkutbe et al.(50) | Male  (467) | 9 to 11 | 27.7  (5.2 – 49.4) | Saudi Arabian |  | -1.0116\*Age-0.1564\*Weight+0.09892\*Height+q.7353\*BMI-8.1772b |
|  | Female  (756) | 8 to 11 | 27.2  (3 – 51.4) |  |  | -0.2069\*Age+0.05958\*Weight-0.03893\*Height+1.4478\*BMI+1.8192b |

Abbreviations: SSF, sum of 4 skin-folds (biceps, triceps, sub-scapular, suprailiac); SSF2, sum of 2 skin-folds (biceps, sub-scapular); BMI, body mass index (kg/m2). a%BF calculated from body density as %BF= [562-4-2 (Age-2)]/BD-[525-4-7 (Age-2)] (32);brecalculated from data provided by Alkutbe et al.(50)

**Supplementary Table 2 Published prediction equations for body composition in children aged 5 – 18 years**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Reference** | **Prediction equation** | **Population** | **Number** | **Age (y)** | **SEE (kg)** | **R2** |
| **Published general bioimpedance spectroscopy predictions for body composition** | | | | | | |
| Moissl et al. (51) | Mixture theory equations for TBW adjusted from BMI using  KB = 4.3  Db = 1.05 (kg/L)  Male ρICW = 273.9 (ohm.cm), ρECW = 40.5 (ohm.cm)  Female ρICW = 264.9 (ohm.cm), ρECW = 39.0 (ohm.cm) | USA (Caucasian, Hispanic, African-American) Germany, Sweden | 76 M,  76 F | 43.7 ± 12.4 |  |  |
| Moon et al. (22) | Mixture theory equations  KB = 4.3 or 4.0\*  Db = 1.05 (kg/L)  Male ρICW = 937.2 (ohm.cm), ρECW = 273.9 (ohm.cm)  Female ρICW = 894.2 (ohm.cm), ρECW = 235.5 (ohm.cm) | USA (Caucasian) | 15 M,  14 F | 18 - 27 |  |  |
| Ward et al. (23) | Mixture theory equations  KB = 4.3 or 4.0\*  Db = 1.05 (kg/L)  Male ρICW = 1029.0 (ohm.cm), ρECW = 355.5 (ohm.cm)  Female ρICW = 927.5 (ohm.cm), ρECW = 289.6 (ohm.cm) | Australian  (predominantly Caucasian) | 85 M,  66 F | 18 - 65 |  |  |
| **Published SFBIA prediction equations for body composition in children aged 5 – 18 years** | | | | | | |
| Rush et al. (34) | FFM = 0.622 (RI) + 0.234 (W) + 1.166 | New Zealand Caucasian, Maori, Pacific Islands | 83 M,  89 F | 5 - 14 | 2.44 | 0.96 |
| Jemaa et al. (35) | TBW = 0.083 (RI) + 0.274 (A) + 0.637 (S) + 0.310 (W) + 2.456 | Tunisian | 67 both sexes | 8 - 11 | 1.34 | 0.92 |
| De Lorenzo et al. (36) | FFM = 0.588 (RI) + 0.21 (W) + 2.33 | Italian Caucasian |  | 7.7 - 13 | 1.0 | 0.96 |
| El Harchaoui et al. (37) | TBW = 0.292 (RI) +0.221 (W) + 0.824 (S) + 0.269 | Moroccan | 82 M,  41 F | 8 - 11 | 1.51 | 0.91 |
| Horlick et al. (38) | TBW = 0.475 (RI) + 0.14 (W) + 0.725 | USA (White, African-American, Asian, Hispanic) | 664 M, 627 F | 4-18 | 0.001 | 0.95 |

SEE = standard error of the estimate; R2 = coefficient of determination; A = age (years); RI = resistance index (H^2/R50, cm^2/ohm); Xc = reactance at 50 kHz; (ohm) W = weight (kg); H = height (cm); S = sex (male = 1, female = 0);\* K value calculated in this study for children