**Supplemental Table 1: Anthropometric and body composition characteristics of children in Vietnam for the total sample and by sex using bioelectrical impedance (BIA) or dual energy x-ray absorptiometry (DXA).**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Total(n=119)** | **Female(n=59)** | **Male(n=60)** | **P-value** |
| Age (months) | 74.3 (11.8) | 73.8 (12.6) | 74.7 (10.9) | 0.692 |
| Height (cm) | 114.4 (7.9) | 113.2 (8.3) | 115.5 (7.5) | 0.107 |
| Weight (kg) | 21.1 (5.6) | 20.3 (5.3) | 21.9 (5.9) | 0.121 |
| Weight for Age (Z-score) | -0.2 (1.6) | -0.4 (1.5) | -0.0 (1.6) | 0.197 |
| Height for Age (Z-score) | -0.4 (1.0) | -0.5 (1.1) | -0.3 (1.0) | 0.231 |
| BMI (Z-score) | 0.0 (1.6) | -0.1 (1.5) | 0.2 (1.8) | 0.279 |
| Triceps skin-fold (mm) | 10.3 (4.9) | 10.2 (4.6) | 10.4 (5.2) | 0.829 |
| Subscapular skinfold (mm) | 8.4 (4.9) | 8.6 (5.1) | 8.1 (4.7) | 0.572 |
| Mid-Upper Arm Circumference (mm) | 18.6 (3.0) | 18.4 (2.8) | 18.8 (3.2) | 0.371 |
| Waist circumference (cm) | 53.5 (7.1) | 52.2 (6.7) | 54.9 (7.3) | 0.037 |
| Hip circumference (cm) | 57.8 (6.9) | 57.3 (6.7) | 58.4 (7.1) | 0.381 |
| Resistance | 745.5 (82.6) | 763.3 (76.9) | 728.0 (84.8) | 0.019 |
| Reactance | 61.3 (6.9) | 59.9 (5.7) | 62.8 (7.7) | 0.021 |
| Resistance index | 17.9 (3.6) | 17.1 (3.3) | 18.8 (3.8) | 0.013 |
| DXA Fat Mass (kg) | 6.6 (3.2) | 6.6 (3.1) | 6.6 (3.3) | 0.879 |
| DXA Percent Fat (%) | 30.0 (7.2) | 31.2 (7.2) | 28.8 (7.0) | 0.076 |
| DXA Fat-Free Mass (kg) | 14.5 (2.9) | 13.6 (2.7) | 15.3 (2.9) | 0.002 |
| Bone Mineral Density (mg/cm2) | 0.685 (0.06) | 0.673 (0.07) | 0.697 (0.06) | 0.036 |

Values are mean (SD); BMI: body mass index; DXA: dual energy x-ray absorptiometry.

**Supplemental Table 2: Prediction models developed for total fat mass using height and resistance as two independent variables from the validation sample using novel models in the validation sample of children in Vietnam.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Model 1** | **Model 2** | **Model 3** | **Model 4** | **Model 5** | **Model 6** | **Model 7** |
| **Results from development sample** |
| Intercept | -1.5031 | 0.089 | 0.452 | 5.896 | 6.002 | 9.783 | 19.73 |
| Age | -0.022 | -0.024 | -0.023 | -0.018 | -0.019 | -0.014 | -- |
| Female | 0.322 | 0.522 | 0.571 | 0.486 | 0.565 | 0.731 | -- |
| Height | -0.086 | -0.134 | -0.131 | -0.168 | -0.171 | -0.152 | -- |
| Weight | 0.488 | 0.640 | 0.646 | 0.789 | 0.789 | 0.710 | -- |
| Resistance | 0.005 | 0.007 | 0.007 | 0.007 | 0.006 | -- | -0.017 |
| Reactance | -0.013 | -0.009 | -0.010 | -0.013 | -- | -- | X2 |
| Waist circumference | 0.063 | 0.068 | 0.088 | -- | -- | -- | -- |
| Hip circumference | 0.027 | 0.031 | -- | -- | -- | -- | -- |
| Subscapular skinfold | 0.130 | -- | -- | -- | -- | -- | -- |
| **Statistics from the validation sample using models created in the development sample**  |
| PRESS | 15.1 | 19.69 | 19.9 | 20.27 | 20.3 | 27.08 | 258.59 |
| RMSE | 0.65 | 0.74 | 0.74 | 0.75 | 0.75 | 0.87 | 2.68 |
| MAE | 0.53 | 0.62 | 0.63 | 0.61 | 0.61 | 0.73 | 2.21 |
| R2 | 0.956 | 0.943 | 0.942 | 0.941 | 0.941 | 0.922 | 0.251 |
| DXAFM | 6.34 (3.14)3 | 6.34 (3.14) | 6.34 (3.14) | 6.34 (3.14) | 6.34 (3.14) | 6.34 (3.14) | 6.34 (3.14) |
| FMPRED | 6.40 (2.85) | 6.42 (2.82) | 6.42 (2.80) | 6.44 (2.80) | 6.43 (2.80) | 6.52 (2.82) | 6.85 (1.44) |
| MSD (DXAFM - FMPRED) | -0.06 | -0.08 | -0.08 | -0.10 | -0.09 | -0.18 | -0.51 |
| MSD 95% CI (LB) | -0.23 | -0.11 | -0.12 | -0.34 | -0.32 | -0.53 | -2.91 |
| MSD 95% CI (UB) | 0.20 | 0.38 | 0.37 | 0.15 | 0.18 | 0.03 | -1.17 |
| MSDboy | -0.16 | -0.13 | -0.12 | -0.08 | -0.03 | -0.09 | -0.67 |
| MSDgirl | 0.01 | -0.03 | -0.04 | -0.12 | -0.15 | -0.26 | -0.39 |

DXAFM: fat mass from dual energy x-ray absorptiometry; FMPRED: predicted fat mass; MAE: Mean Absolute Error; MSD: Mean Signed Difference; PRESS: Predicted Residual Error Sum of Squares; RMSE: Root Mean Square Error; RI: Resistance index (height in cm2/resistance)

1Values are coefficient

2X: Predictor was excluded by LASSO

3Values are mean (SD)

**Supplemental Table 3: Prediction models developed for total fat-free mass using height and resistance as two independent variables from the validation sample using novel models in the validation sample of children in Vietnam.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Predictors** | **Model 1** | **Model 2** | **Model 3** | **Model 4** | **Model 5** | **Model 6** | **Model 7** |
| **Regression coefficients to predict FFM from selected variables in the development sub-sample** |
| Intercept | -1.3721 | -1.725 | -1.725 | -1.817 | 0.441 | 1.896 | -2.932 |
| Age | 0.024 | 0.025 | 0.025 | 0.025 | 0.037 | 0.062 | -- |
| Female | -0.244 | -0.249 | -0.249 | -0.259 | -0.486 | -0.835 | -- |
| Weight | 0.226 | 0.159 | 0.159 | 0.160 | 0.175 | 0.398 | -- |
| Resistance index | 0.454 | 0.495 | 0.495 | 0.495 | 0.439 | -- | 0.772 |
| Reactance | 0.036 | 0.037 | 0.037 | 0.038 | -- | -- | 0.059 |
| Waist circumference | -0.011 | X | X | -- | -- | -- | -- |
| Hip circumferencce | X | X | -- | -- | -- | -- | -- |
| Subscapular skinfold | -0.039 | -- | -- | -- | -- | -- | -- |
| **Statistics from the validation sub-sample using models created in the development sub-sample**  |
| PRESS | 19.3 | 20.36 | 20.36 | 20.36 | 20.77 | 40.4 | 25.35 |
| RMSE | 0.73 | 0.75 | 0.75 | 0.75 | 0.76 | 1.06 | 0.84 |
| MAE | 0.56 | 0.58 | 0.58 | 0.58 | 0.58 | 0.83 | 0.62 |
| R2 | 0.920 | 0.916 | 0.916 | 0.916 | 0.914 | 0.833 | 0.895 |
| DXAFFM | 14.12 (2.63)3  | 14.12 (2.63) | 14.12 (2.63) | 14.12 (2.63) | 14.12 (2.63) | 14.12 (2.63) | 14.12 (2.63) |
| FFMPRED | 14.21 (2.65) | 14.22 (2.64) | 14.22 (2.64) | 14.21 (2.65) | 14.26 (2.69) | 14.18 (2.66) | 14.25 (2.59) |
| MSD (DXAFFM - FFMPRED) | -0.09 | -0.10 | -0.10 | -0.09 | -0.14 | -0.06 | -0.13 |
| MSD 95% CI (LB) | -0.03 | -0.01 | -0.01 | -0.01 | 0.07 | 0.78 | -0.54 |
| MSD 95% CI (UB) | 0.45 | 0.48 | 0.48 | 0.49 | 0.56 | 1.48 | 0.01 |
| MSDboy | 0.18 | 0.18 | 0.18 | 0.18 | 0.02 | 0.10 | 0.20 |
| MSDgirl | -0.31 | -0.32 | -0.32 | -0.31 | -0.27 | -0.19 | -0.40 |

CI: confidence interval; DXAFFM: fat free mass from dual energy x-ray absorptiometry; FFMPRED: predicted fat mass; LB: lower bound; MAE: Mean Absolute Error; MSD: Mean Signed Difference; PRESS: Predicted Residual Error Sum of Squares; RMSE: Root Mean Square Error; UB: Upper bound.

1Values are coefficient

2X: Predictor was excluded by LASSO

3Values are mean (SD)

**Supplemental Table 4: Prediction models developed for percent body fat and statistics using height and resistance as two independent variables from the validation sample using novel models in the validation sample of children in Vietnam.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Predictors** | **Model 1** | **Model 2** | **Model 3** | **Model 4** | **Model 5** | **Model 6** | **Model 7** |
| **Regression coefficients to predict PBF from selected variables in the development sub-sample** |
| Intercept | 24.61 | 28.39 | 30.31 | 54.33 | 54.88 | 68.80 | 55.70 |
| Age | -0.13 | -0.13 | -0.13 | -0.11 | -0.11 | -0.09 | -- |
| Female | 2.22 | 2.93 | 3.15 | 2.77 | 3.15 | 3.76 | -- |
| Height | -0.34 | -0.48 | -0.47 | -0.65 | -0.67 | -0.59 | -- |
| Weight | 0.77 | 1.23 | 1.27 | 1.92 | 1.92 | 1.62 | -- |
| Resistance | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 | -- | -0.02 |
| Reactance | -0.06 | -0.04 | -0.04 | -0.06 | -- | -- | -0.12 |
| Waist circumference | 0.25 | 0.29 | 0.38 | -- | -- | -- | -- |
| Hip circumference | 0.13 | 0.14 | -- | -- | -- | -- | -- |
| Subscapular skinfold | 0.44 | -- | -- | -- | -- | -- | -- |
|  |
| PRESS | 332.46 | 381.48 | 386.03 | 391.46 | 399.21 | 489.3 | 1675.85 |
| RMSE | 3.04 | 3.26 | 3.27 | 3.30 | 3.33 | 3.69 | 6.82 |
| MAE | 2.47 | 2.71 | 2.77 | 2.74 | 2.76 | 3.23 | 5.76 |
| MSD | -0.35 | -0.40 | -0.39 | -0.51 | -0.47 | -0.79 | -1.00 |
| R2 | 0.827 | 0.801 | 0.799 | 0.796 | 0.792 | 0.745 | 0.127 |
| DXAPBF | 29.59 (7.41) | 29.59 (7.41) | 29.59 (7.41) | 29.59 (7.41) | 29.59 (7.41) | 29.59 (7.41) | 29.59 (7.41) |
| PBFPRED  | 29.9 (5.80) | 29.98 (5.74) | 29.98 (5.70) | 30.09 (5.77) | 30.06 (5.85) | 30.38 (5.83) | 30.59 (2.38) |
| MSD DXAPBF - PBFPRED | -0.34 | -0.39 | -0.39 | -0.50 | -0.47 | -0.79 | -1.00 |
| MSD 95% CI (LB) | -2.52 | -2.15 | -2.20 | -2.96 | -2.85 | -3.66 | -10.29 |
| MSD 95% CI (UB) | -0.52 | -0.01 | -0.05 | -0.80 | -0.67 | -1.27 | -5.82 |
| MSDboy | -0.65 | -0.59 | -0.52 | -0.34 | -0.10 | -0.32 | -2.51 |
| MSDgirl | -0.10 | -0.24 | -0.29 | -0.64 | -0.77 | -1.17 | 0.20 |

DXAPF: percent body fat from dual energy x-ray absorptiometry; PBFPRED: predicted percent body fat; MAE: Mean Absolute Error; MSD: Mean Signed Difference; PRESS: Predicted Residual Error Sum of Squares; RMSE: Root Mean Square Error; RI: Resistance index (height in cm2/resistance)

1Values are coefficient

2X: Predictor was excluded by LASSO

3Values are mean (SD)

**Supplemental Table 5: Statistical results from using the newly developed prediction equation in the validation sub-sample compared to a prediction equation developed from a multi-ethnic group of children from the Middle East and Asia(26).**

The test equation was as follows:FFM = (0.299 × height2/resistance) + (0.086 × height) + (0.245 × weight) + (0.260 × age) + (0.901 × sex) – (0.415 × ethnicity (Thai ethnicity =1, others = 0) - 6.952

|  |  |  |
| --- | --- | --- |
|  | Our model  | Using models by Liu (2011) |
| PRESS | 20.77 | 65.04 |
| RMSE | 0.76 | 1.35 |
| MAE | 0.58 | 1.06 |
| MSD | -0.14 | -0.99 |
| MSD 95% CI (LB) | 0.07 | -0.93 |
| MSD 95% CI (UB) | 0.56 | -0.32 |
| R2 | 0.914 | 0.731 |
| DXAFFM | 14.12 (2.63) | 14.12 (2.63) |
| FFMPRED | 14.26 (2.69) | 15.11 (3.15) |
| DXAFFM - FFMPRED | -0.14 | -0.99 |
| MSDboy | 0.02 | -1.13 |
| MSDgirl | -0.27 | -0.88 |