SUPPLEMENTARY INFORMATION

Equation 1 by Hume (1966) [1]: The author measured total body water (TBW) from antipyrine space in a United Kingdom (UK) population and used this to derive lean body mass (LBM). The equation predicts LBM based on body weight, height and sex.

Men LBM = 0.32810*W(kg) + 0.33929*H(cm) – 29.5336
Women LBM = 0.29569*W(kg) + 0.41813*H(cm) – 43.2933

where, W(kg) is weight in kilograms and H(cm) is height in centimeters.

Equation 2 by Hume & Weyers (1971) [2]: The equation predicts TBW based on body weight, height and sex as the independent variables based on data from a UK population. The LBM was predicted as a fixed percentage (%) of TBW as TBW*100/73 as follows:

Men LBM = [0.296785*W(kg) + 0.194786*H(cm) – 14.012934]*100/73
Women LBM = [0.183809*W(kg) + 0.344547*H(cm) – 35.270121]*100/73

where, W(kg) is weight in kilograms. H(cm) is height in centimeters.

Equation 3 by James & Waterlow (1976) [3]: The authors used an equation derived by T.P. Eddy from datasets based on other UK studies to calculate body fat as a percentage of weight (%BF). The equation predict %BF based on weight, height and sex as the independent variables. The LBM was calculated by subtracting BF weight from the whole body weight as follows:

Men LBM = W(kg) – 1.281*[W(kg)/H(m)^2 – 10.13]*W(kg)/100
Women LBM = W(kg) – 1.48*[W(kg)/H(m)^2 – 7.0]*W(kg)/100

where, W(kg) is weight in kilograms, and H(m) is height in meters.

Equation 4 by Hallynck (1981) [4]: Hallynck et al. [4] and other authors (such as Green & Duffull (2002) [5]) have used a simplified version of the original equation reported by James & Waterlow (1976) [3] as follows:

Men LBM = 1.10*W(kg) – 128*[W(kg)/H(cm)]^2
Women LBM = 1.07*W(kg) – 148*[W(kg)/H(cm)]^2

where, W(kg) is the weight in kilograms. H(cm) is height in centimeters.

Equation 5 by Boer (1984) [6]: The author used the relationship among TBW, body weight and height as reported by Hume & Weyers [2], as well as TBW and LBM as reported by Rathbun & Pace [7]. The equation for LBM was obtained in terms on BW and height by eliminating TBW as follows:

Men LBM = 0.407*W(kg) + 26.7*H(m) - 19.2

Women LBM = 0.252*W(kg) + 47.3*H(m) – 48.3

where, W(kg) is the weight in kilograms and H(m) is height in meters.

Equation 6 by Deurenberg et al. (1991) [8]: The authors first predicted %BF using densitometry and anthropometry data from a Dutch population. The equation predicted %BF based on weight, height, age and sex as the independent variables. The LBM was calculated by subtracting BF weight from the whole body weight as follows:

LBM = W(kg) – [1.2*BMI + 0.23*AGE(yrs) – 10.8*SEX – 5.4]*W(kg)/100

where, W(kg) is the weight in kilograms, AGE(yrs) is the age in years, SEX uses value 1 for men and 0 is for women, and BMI is body mass index in kg/m^2. This equation is for adults aged above 15 years. A separate equation for children aged 15 years or younger was derived but not mentioned here for comparison.

Equation 7 by Zasadny & Wahl (1993) [9]: The authors cited an equation originally published by the American Dietetic Association based on data from a North American population. This equation was also used later by Graham et al. [10]. The equations predict LBM based on height and sex as the independent variables as follows:

Men LBM = 48 + 1.06*[H(cm) – 152]
Women LBM = 45.5 + 0.91*[H(cm) – 152]

where, H(cm) is height centimeters.

Equation 8 by Morgan & Bray (1994) [11]: This review paper used an incorrectly simplified version of the James & Waterlow equation [3] as follows:

Men LBM = 1.10*W(kg) – 120*[W(kg)/H(cm)]^2
Women LBM = 1.07*W(kg) – 148*[W(kg)/H(cm)]^2

where, W(kg) is the weight in kilograms and H(cm) is height in centimeters. The incorrect version of the James & Waterlow equation is still being used in the literature [12, 13].

Equation 9 by Gallagher et al. (2000) [14]: The authors developed this formula based on two independent methods, namely dual-energy X-ray absorptiometry (DXA) and four-compartment (4C) [15] methods, to predict %BF corresponding to three different thresholds for body mass index (BMI) (i.e., underweight: BMI <18.5, overweight: BMI 25-29.9, and obesity: BMI ≥30 kg/m^2). They combined the data from White and African American subjects for 4C %BF method to provide simplified equations for two reasons: (1) the dependence of %BF on BMI differed significantly between White and African Americans, but the magnitude of this effect was between 1–2% and considered negligible; (2) a high correlation was observed between %BF measured from DXA and the 4C model for both sexes in White and African Americans. The equation predicts %BF based on weight, BMI, age and sex as the independent variables. The LBM was calculated by subtracting BF weight from the whole body weight as follows:

LBM = W(kg) – [64.5 – 848/BMI + 0.079*AGE(yrs) – 16.4*SEX + 0.05*SEX*AGE(yrs) + 39*SEX/BMI]*W(kg)/100

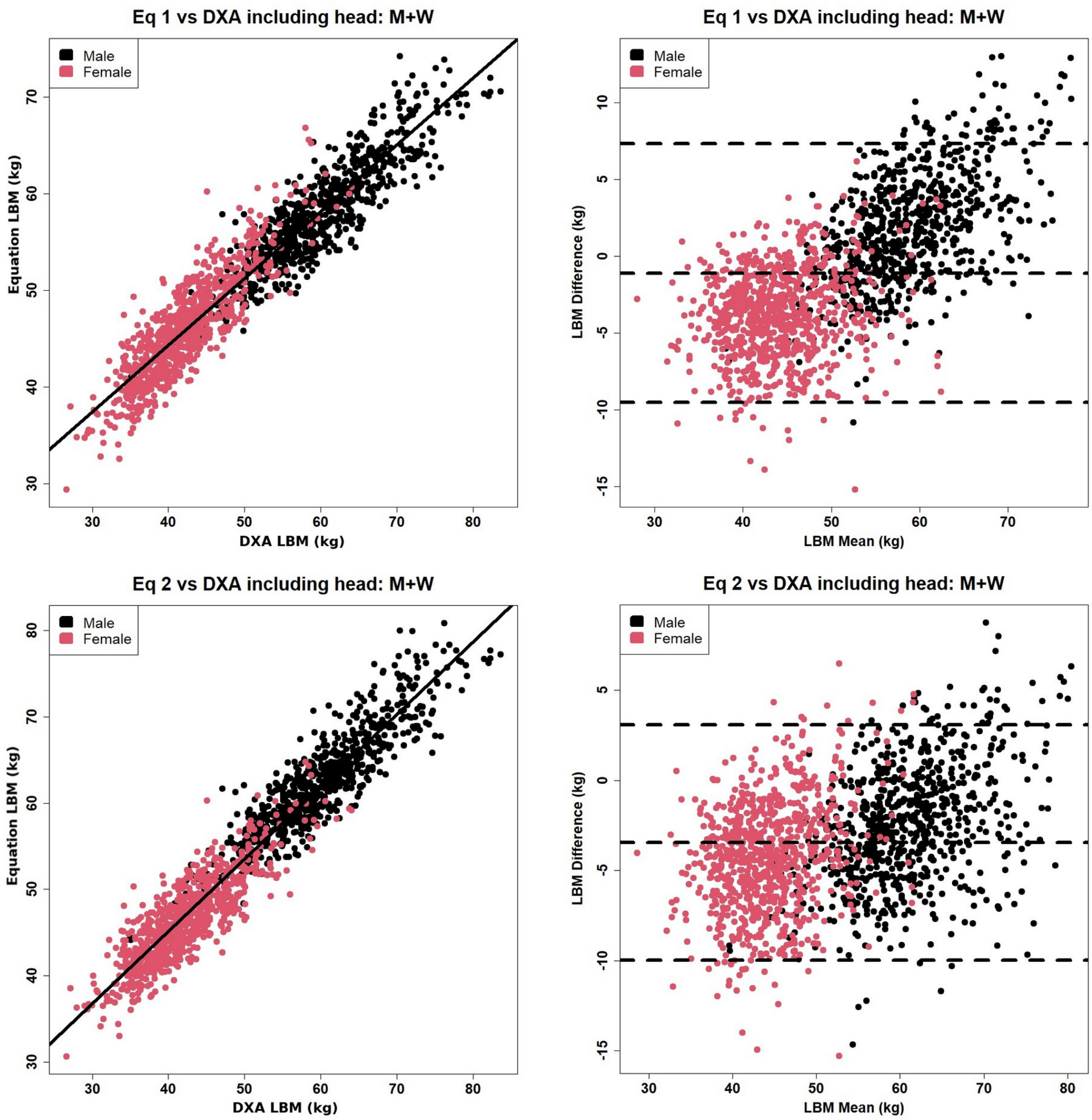
where, W(kg) is weight in kilograms, AGE(yrs) is the age in years, SEX uses value 1 for men and 0 is for women, and BMI is body mass index in kg/m^2. No subjects with Asian ethnicity were included in the model to obtain this equation.

Equation 10 by Janmahasatian et al. (2005) [16]: The authors developed their equations using fat free mass (FFM) data obtained from DXA and bioimpedance measurements in an Australian population and assumed FFM to be approximately equal to LBM since lipids form only 3-5% of total body weight can be considered negligibly small. The equation predict FFM based on weight, height and sex as the independent variables as follows:

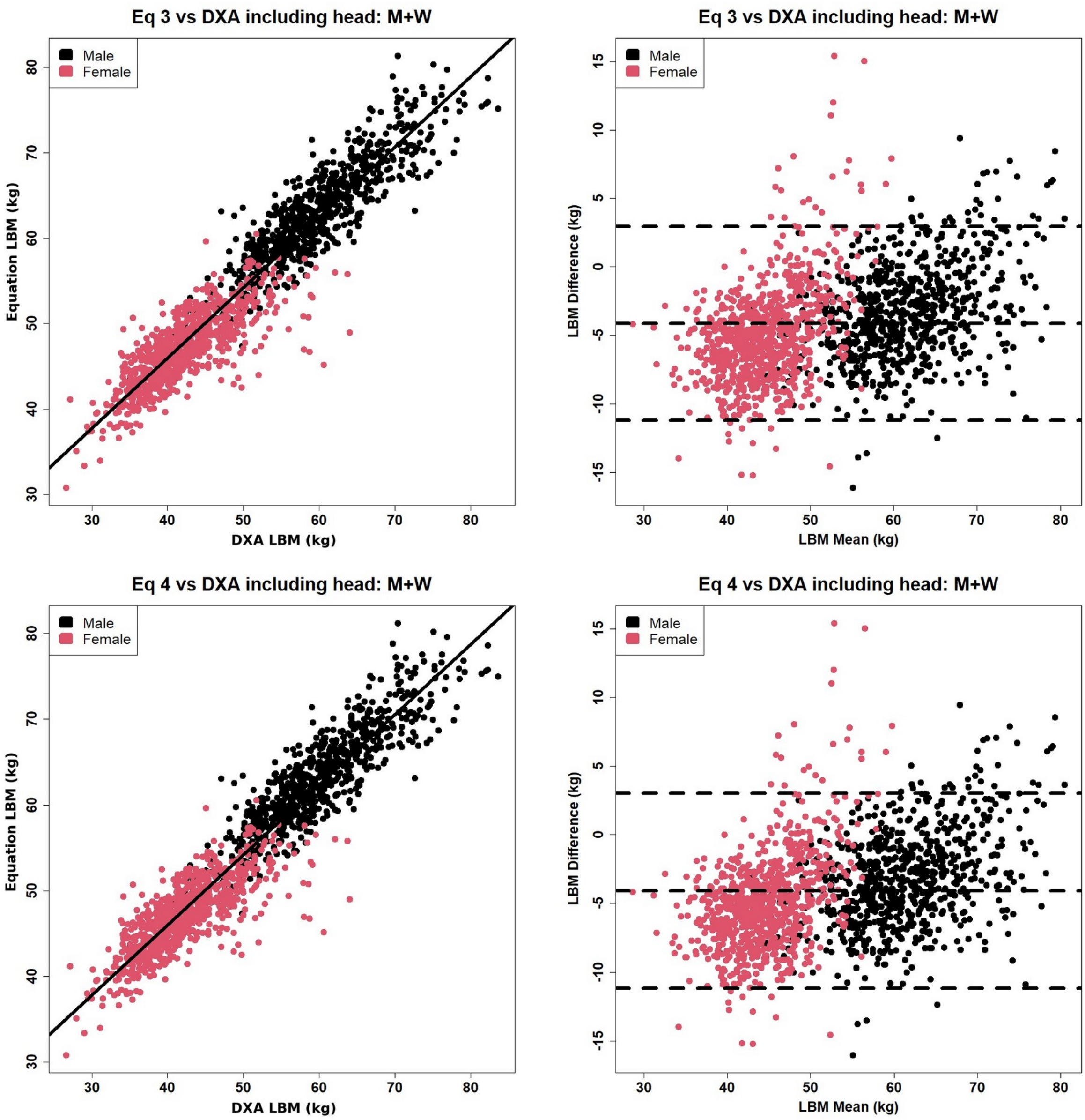
Men LBM = 9270*W(kg)/(6680 + 216*BMI)

Women LBM = 9270*W(kg)/(8780 + 244*BMI)

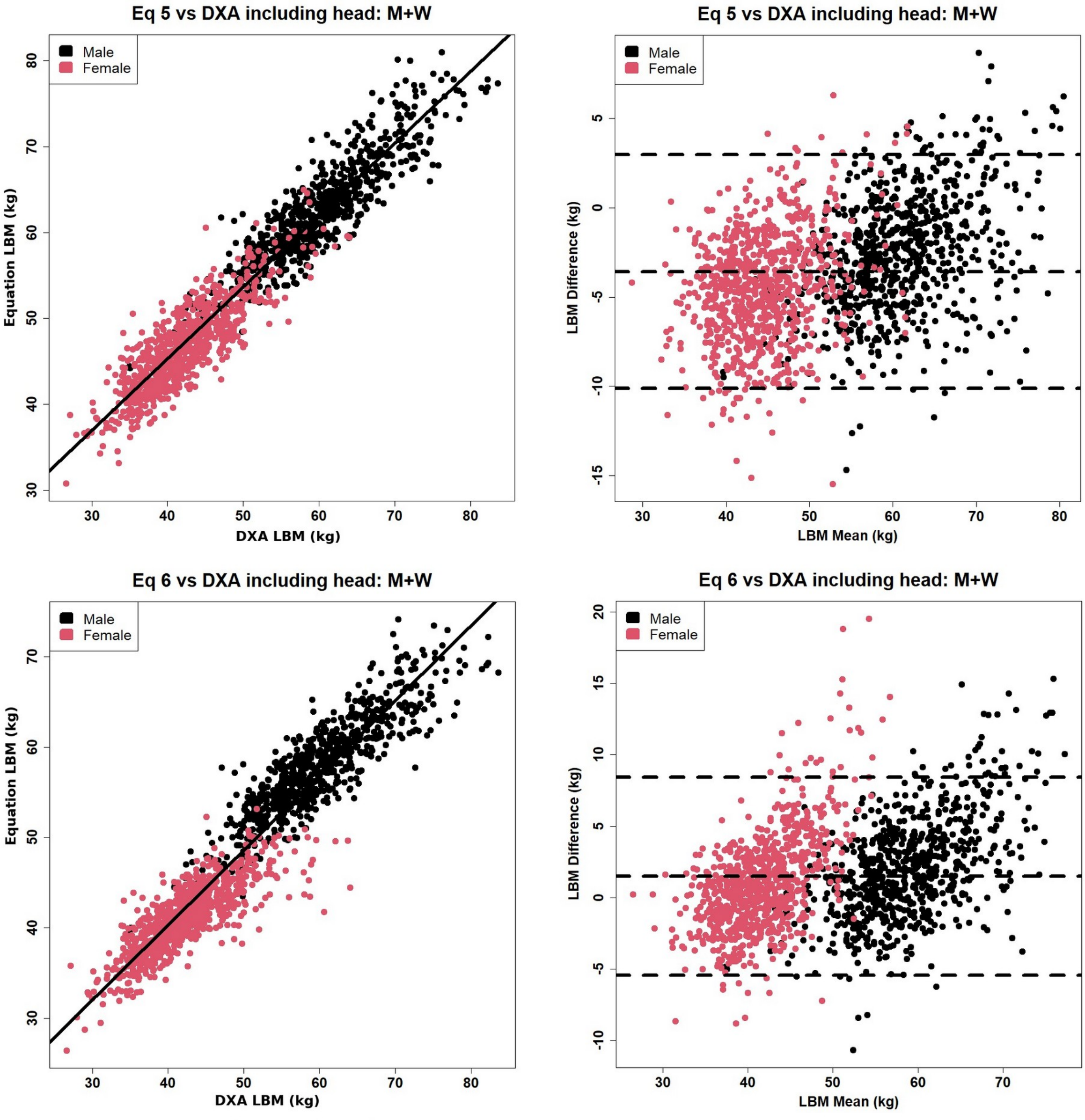
where, W(kg) is weight in kilograms and BMI is body mass index in kg/m^2.



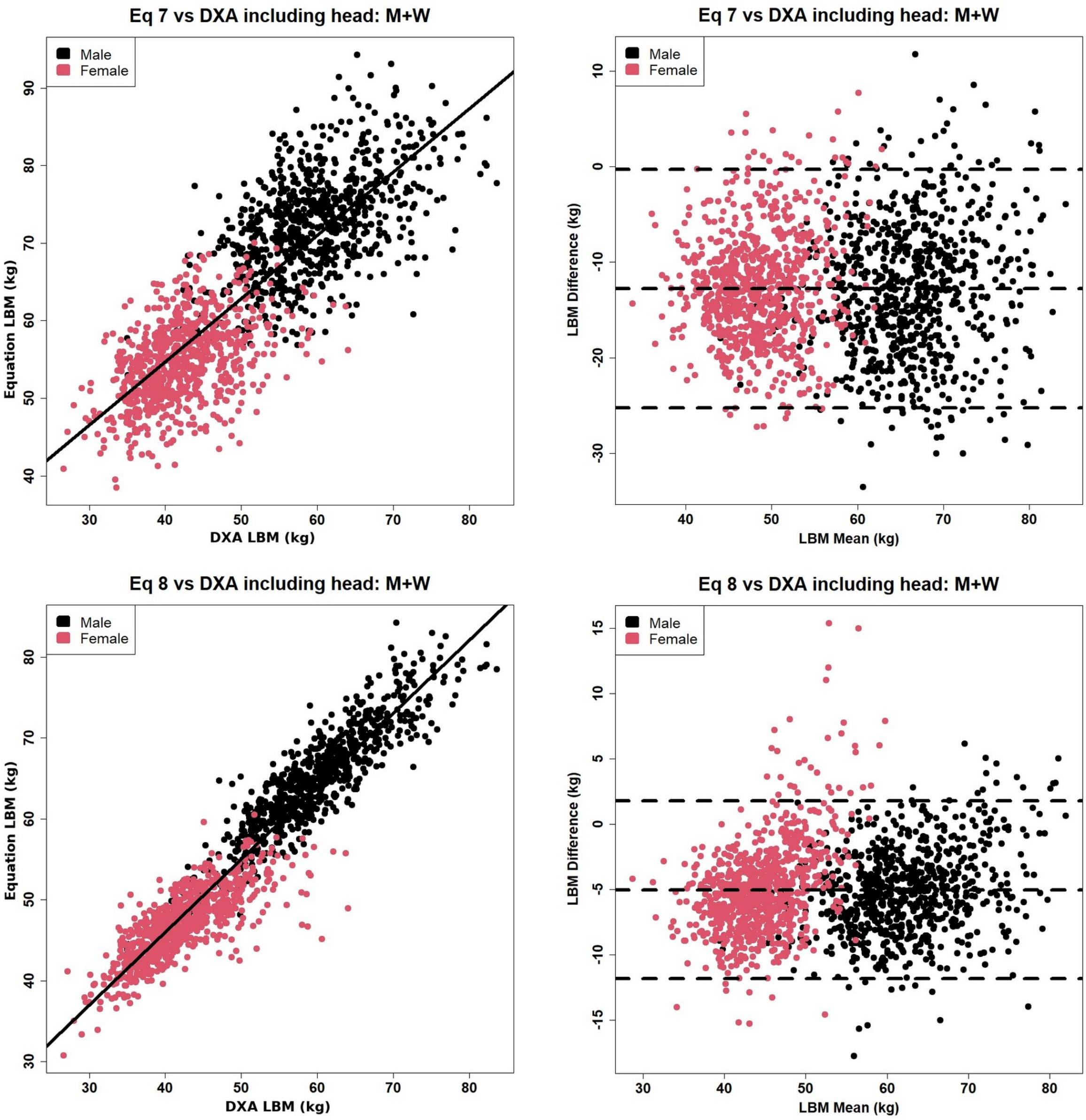
SUPPLEMENTAL FIGURE 1: (A) Scatter and (B) Bland-Altman plot of the relationship between lean body mass measured by dual-energy X-ray absorptiometry (DXA) and predicted by Equation 1. (C) and (D): Same for Equation 2.



SUPPLEMENTAL FIGURE 2: (A) Scatter and (B) Bland-Altman plot of the relationship between lean body mass measured by dual-energy X-ray absorptiometry (DXA) and predicted by Equation 3. (C) and (D): Same for Equation 4.



SUPPLEMENTAL FIGURE 3: (A) Scatter and (B) Bland-Altman plot of the relationship between lean body mass measured by dual-energy X-ray absorptiometry (DXA) and predicted by Equation 5. (C) and (D): Same for Equation 6.



SUPPLEMENTAL FIGURE 4: (A) Scatter and (B) Bland-Altman plot of the relationship between lean body mass measured by dual-energy X-ray absorptiometry (DXA) and predicted by Equation 7. (C) and (D): Same for Equation 8.

Supplement References

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