Development of a DXA-derived Body Volume Equation in Hispanic Adults for Administering in a 4-compartment Model

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ABSTRACT

The necessity of using underwater weighing (UWW) or air displacement plethysmography (ADP) for body volume (BV) restricts the use of a four-compartment (4C) model to research settings. As a result, dual energy X-ray absorptiometry (DXA) has been proposed as an alternative, which would be useful for clinical settings. Nonetheless, it is unknown whether DXA-derived BV is valid in a 4C model for Hispanics. **PURPOSE:** The purpose of the current study was two-fold: 1) to develop a new DXA-derived BV equation with the GE-Lunar Prodigy while utilizing UWW as a criterion and 2) cross-validate 4C models when utilizing the new DXA-derived BV equation (4C-DXA$_{NICKERSON}$), Wilson DXA-derived BV equation (4C-DXA$_{WILSON}$), and air displacement plethysmography (ADP)-derived BV (4C-ADP) in Hispanic adults. **METHODS:** 191 Hispanic adults (18-45yrs) participated in the current study. The development sample consisted of 60 females and 60 males whereas the cross-validation sample comprised of 41 females and 30 males. Criterion body fat percentage (BF%) and fat-free mass (FFM) were determined using a 4C model with UWW as a criterion for BV (4C-UWW). The new DXA-derived BV equation (Nickerson) was developed by linearly regressing UWW-derived BV with DXA fat mass (FM), lean mass (LM), and bone mineral content (BMC). 4C-DXA$_{NICKERSON}$, 4C-DXA$_{WILSON}$, and 4C-ADP were compared against 4C-UWW in the cross-validation sample. **RESULTS:** The new DXA-derived BV equation (L) was generated in the development sample as follows: (FM/0.91) + (LM/1.06) + (BMC/16.95) + 0.268. 4C-DXA$_{NICKERSON}$, 4C-DXA$_{WILSON}$, and 4C-ADP all produced similar mean values (BF%=21.04±5.99, 22.23±6.93, and 20.62±6.26%, respectively) when compared to 4C-UWW (21.29±6.14%) in Hispanic males (all p>0.05). 4C-DXA$_{NICKERSON}$ also yielded similar BF% and FFM values as 4C-UWW when evaluating the constant error (CE) in Hispanic females (CE=-0.79% and 0.38kg; p=0.060 and 0.174, respectively). However, 4C-DXA$_{WILSON}$ produced significantly different BF% and FFM values (CE=3.22% and -2.20kg, respectively; both p<0.001). Additionally, 4C-DXA$_{WILSON}$ yielded significant proportional bias when estimating BF% (coefficient=0.226; p<0.001) whereas 4C-ADP produced significant proportional bias for BF% and FFM (coefficient=0.188 and -0.084; both p<0.05) when evaluated in Hispanic females. **CONCLUSION:** Current study findings demonstrate that 4C-DXA$_{NICKERSON}$ is a valid measure of BV in Hispanics and is recommended for use in clinics where DXA is the main body composition assessment technique.