

Arm skin water assessed via 300 MHz tissue dielectric constant (TDC) measurements: Dependence on total body water, fat and arm muscle mass

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Skin TDC values depend on free and bound water and have been used to help detect lymphedema associated with breast cancer treatment and to evaluate other edematous conditions. For unilateral lymphedema, TDC arm ratios are useful but for bilateral cases absolute TDC values are needed. Since tissue water likely varies with total body fat and water it is useful to ascertain if TDC values are quantifiably linkable to either parameter. Until now there has been no systemic determination of possible TDC dependencies on percentages of total body water (TBW%), total body fat (FAT%), arm muscle mass (MM) or percentage arm fat (FATARM%). Such information is important if TDC measurements are to be optimally useful clinically. Toward this end bilateral anterior forearm and biceps TDC measurements were made in 30 male and 30 female seated subjects with age of 28.0 ± 9.8 years. TDC values, as indices of tissue water, were obtained to depths of 1.5 and 2.5 mm below the epidermis. TBW%, arm muscle mass as a percentage of body weight (MM%), FAT% and FATARM% were determined using bioimpedance methods. Results show the expected inverse relationship between TBW% and FAT% ($r = -0.985$, $p < 0.001$). Results also show that TDC values at forearm and biceps are most strongly positively correlated to MM% at forearm ($r = 0.830$, $p < 0.001$) and biceps ($r = 0.790$, $p < 0.001$) respectively and are significantly negatively correlated to FATARM%. TDC values are also positively correlated with TBW% and negatively correlated to FAT%. The strongest correlations were for forearm 1.5 mm depth TDC values yielding a linear regression equation of $TDC = 0.465(TBW\%) + 7.94$, ($r=0.700$) and $TDC = -0.319(FAT\%) + 41.2$ ($r=0.736$). These findings provide an initial basis for establishing reference TDC values that include considerations of a patient's TBW% and FAT%.

Florida Academy of Sciences Annual Meeting
Ft. Lauderdale Florida
March 8-9 2013