

Title: Skin Tissue Dielectric Constant of Women Participating in a Weight Loss Program

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Background: Tissue dielectric constant (TDC) measurements at 300 MHz are used to assess skin water and edema in a variety of conditions. This includes detecting and tracking breast cancer related lymphedema. Because these women have weight changes over time it is unclear what effect weight changes have on TDC. Since fat has lower water content than dermal structures we hypothesize that weight loss will cause an increase in TDC values.

Objective(s): (1) To test this hypothesis by measuring TDC values at standardized arm sites in women prior to and during a structured weight loss program and (2) to determine if TDC changes within arm tissue are generalizable to upper body skin such as the face. The present report goal is to document TDC baseline values assessed prior to program start.

Methods: Women (38.4 ± 12.4 years) enrolled in the FitandTrim Medical dietary and vitamin therapy program for weight loss were evaluated after signing an NSU approved consent. To date 12 women have been evaluated. TDC measurements were made with subjects seated using the non-invasive open-ended coaxial transmission line method (MoistureMeterD) using probes measuring to effective depths of 0.5, 1.5- and 2.5-mm on the medial forearm and biceps bilaterally. Measurements to a depth of 1.5 mm was done on the neck and on the face at the jowl and submental areas. Each measurement takes about 7 seconds after touching the skin. All measurements were in triplicate and averaged. Body composition features included total body fat percentage ($39.5 \pm 8.5\%$), total body water percentage ($44.3 \pm 6.1\%$) and extracellular to total water ratio (0.375 ± 0.008).

Results: TDC values were symmetric with respect to dominant (DOM) and nondominant (NDOM) sides with no statistically significant differences between DOM and NDOM sides (Wilcoxon, $p > 0.3$). Baseline average TDC values (mean \pm SD) at 1.5 mm depth at forearm, biceps, neck, jowl and submental area were 29.5 ± 2.6 , 25.5 ± 1.9 , 30.3 ± 3.0 , 31.9 ± 4.2 , and 32.0 ± 2.2 . TDC values measured to 1.5 mm depth were significantly greater ($p < 0.001$) than measured to a depth of 2.5 mm on forearm (29.5 ± 2.6 vs. 25.2 ± 2.0) and also on biceps (25.5 ± 1.9 vs. 21.4 ± 1.8).

Conclusions: These initial baseline findings are the first to quantitatively characterize TDC-related skin properties of women with initially well-elevated total body fat percentages. This finding alone contributes to our understanding of the way in which this type of body composition may impact skin tissue water. Moreover, they provide for a framework for the evaluation of weight-loss related changes as time-sequential measurements on these participants progresses.