**Title:** Tissue Dielectric Constant (TDC) Values for use to Detect Water Content in Male Arms as a Baseline for Potential use in Early Detection of Lymphedema in Male Breast Cancer Assessed in Two Age Groups

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**Background:** Breast cancer (BC) treatment-related lymphedema is a recognized complication in women and methods to help detect its insidious development include measurements of local changes in arm skin water based on non-invasive measurements of the TDC. Although BC is rare in males it does occur (1/100,000 men) and there is no male reference TDC normative data from which lymphedema changes may be judged.

**Objective:** Our goal was to provide TDC reference data for males and to investigate the role of body composition as a determinant of locally measured TDC values. We also utilized two distinct age groups (under 30 and over 50) to detect possible age-related differences in TDC values and to generate an age appropriate reference range for males.

**Methods:** To date, TDC was measured bilaterally on anterior forearms and biceps of 47 adult males, 30 under 30 years and 17 over 50 years. This procedure requires touching the skin with sensors of different size for about 10 seconds. The different sizes allow measurements of TDC (and hence relative water content) to effective depths of 0.5, 1.5, 2.5 and 5.0 mm below the epidermis. Each measurement was done in triplicate and averaged. Whole body and segmental composition of each subject was assessed by bioimpedance at 50 KHz with a scale upon which subjects stood. TDC data were analyzed to determine TDC absolute values, dominant/non-dominant arm differences and ratios and to determine if TDC values correlated with body composition parameters. Arm girths were measured at all sites at which TDC was measured with a tape measure.

**Results:** Young vs. old groups (mean ± SD) differed significantly (p<0.001) by age (25.2±2.3 vs. 70.0±10.3 years), total body fat % (16.7±5.7 vs. 25.6±6.7) and total body water % (59.0±4.7 vs. 53.1±4.9). TDC values measured at forearm and biceps monotonically decreased (p<0.001) in both young and older groups with increasing measurement depth. At the shallowest depth (0.5 mm) young TDC values at forearm and biceps (38.2±5.1 and 38.7±4.2) were significantly less (p<0.001) than for the older group with values of 44.7±5.8 and 43.5±5.3 respectively. However, TDC values were not significantly different between groups at any other depth. TDC ratios (dominant arm/non-dominant) were not different between young and old at any depth. TDC values measured at all depths at each site for each group were directly correlated with total body water percentage and inversely correlated with total body fat percentage. The strongest correlations were between TDC values measured to a depth of 5 mm with correlation coefficients ranging from -0.771 to –0.759 for fat percentage and 0.768 to 0.719 for water.

**Conclusions:** Despite large differences in age, skin tissue water assessed by TDC measurements values showed age-related differences only at the shallowest epidermal-to-target depth of 0.5 mm. TDC values indicate greater %water within this depth for the older group. This unexpected result may be due to more bound water in this region that is uniquely measureable at the employed 300 MHz frequency. Whatever the reason, the age dependent difference should be considered when comparing TDC values among patients of widely varying age.