Tissue Dielectric Constant Measured at 300 MHz as an Index of Localized Skin Water in Persons with Diabetes Mellitus

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The goal of this research was to test the hypothesis that in persons with diabetes (DM) skin water is inversely related to their HbA1c values. The basis for the hypothesis relates to the fact that skin changes in persons with DM are associated with altered protein glycation that affects water binding and thus may be dependent on HbA1c. To test this hypothesis skin-to-fat tissue water was estimated by measuring the skin tissue dielectric constant (TDC). TDC values are largely dependent on local tissue water content and are measured noninvasively by touching the skin with a suitable probe for about 6 seconds. In the present study TDC was measured in triplicate at three anatomical sites on the persons dominant side; anterior forearm, lateral calf and foot dorsum in 42 DM patients to depths of 0.5, 1.5, 2.5 and 5.0 mm below epidermis. Total body fat (TBF) and total body water (TBW) were determined via bioimpedance at 50 KHz. The results showed that TDC values monotonically decreased with measurement depth at all sites with TDC values at all depths significantly different from each other (p<0.001). At all depths except 0.5 mm there were differences in TDC values among sites (p<0.001) with foot values greater than leg and leg greater than forearm. TDC values were negatively correlated with HbA1c only for foot and then only at a 1.5 mm depth. There was also a small positive correlation between HbA1c and arm fat. Based on the current findings we conclude that our initial hypothesis is only weakly supported since the foot TDC-HbA1c correlation explains only 11% of the observed variation. We thus conclude that over the range of HbA1c values evaluated there is little effect of HbA1c on skin water as judged by TDC measurements. This finding suggests that persons with DM may be evaluated with TDC methods without fear of possible confounding effects related to variations in HbA1c. Further, the TDC values herein obtained provide a DM-related TDC reference data set useful for subsequent research studies.