

## Letter to the Editor

### The Use of the Terms Bipolar and Tetrapolar

I read with great interest the recent paper by Dr. Dittmar, entitled "Comparison of Bipolar and Tetrapolar Impedance Techniques for Assessing Fat Mass" published in a recent issue of the *American Journal of Human Biology* (Dittmar, 2004). This paper provides a valuable contribution to the assessment of body composition using bioelectrical impedance analysis (BIA). While I agree entirely with the conclusions drawn by Dr. Dittmar, I would like to take the opportunity to correct a misconception regarding the use of the terms bipolar and tetrapolar.

All of the BIA instruments used by Dr. Dittmar in her study use the tetrapolar technique for measuring biological impedances. The tetrapolar technique refers to the electrical measurement system adopted by the instrument manufacturer and not to the body region being measured. In the tetrapolar or four-terminal method, the test current is introduced through one pair of terminals and the voltage drop, and hence, impedance is measured through a second pair of terminals placed, typically, a few centimetres proximal to the current injection terminals. In contrast, the bipolar, or two-terminal technique, both the current and voltage sensing circuits use a single pair of terminals.

Since the aim in BIA is to measure the impedance of the deep tissues, the four-terminal method is preferred as the voltage drop measured using a separate set of electrodes will be that of the deep tissues, since negligible

current is drawn through the electrode. Indeed a combination of the bipolar and tetrapolar techniques has been proposed as a method for the estimation of subcutaneous adipose tissue thickness [Elia and Ward, 1999; for a more detailed explanation the reader is referred to the paper by Oldham (Oldham, 1996)].

Both the foot-to-foot instrument (Tanita, TBF-538) and the hand-to-hand instrument (Omron, BF-302) are tetrapolar instruments. It is incorrect to refer to these instruments as bipolar. In the case of the TBF-538, current is injected through the electrode pads under the front of each foot and the voltage measured by the electrodes under the heel. The Omron device incorporates the two pairs of electrodes in the grip handles on either side of the display unit.

Although the misreporting of the two segmental approaches as bipolar techniques in no way invalidates the conclusions drawn by Dr. Dittmar, it is important that readers of this and other articles on BIA appreciate the difference between bipolar and tetrapolar BIA.

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### LITERATURE CITED

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