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Measuring body composition with bio-electrical impedance analysis in acutely malnourished children: lessons from operational research

Background: Bio-electrical Impedance Analysis (BIA) is a noninvasive and relatively simple assessment of body composition via a harmless electric current using portable equipment. Height-adjusted resistance and reactance values obtained hence can be plotted on a graph and the vector displacement analyzed relative to a reference population. This bio-electrical impedance vector analysis (BIVA) is proposed to visualize changes in the magnitude of fat-free tissue and hydration status, and may provide useful information on the evolution of a disease or the success of a therapy.

Severe acute malnutrition (SAM) in children 6 to 59 months is a condition currently diagnosed based on weight-for-height and/or mid-upper-arm circumference cut-offs or presence of bi-pedal edema. These simple body measures do not distinguish between the type of tissue lost or regained, or health status. BIA could potentially fill this gap, establishing the severity of the condition and informing on the success of the therapeutic approach. Body composition following treatment should reflect that of normal children to avoid relapse and long-term risk of chronic disease. More data is needed from representative samples of SAM children to understand their body composition upon admission and at discharge from therapeutic treatment. This information is crucial in understanding the potential need to revise the treatment and its targeting, in order to optimize health outcomes of SAM children treated and to ensure those most in need receive adequate attention and care.

Methods: The challenge in measuring BIA among SAM children is obtaining good quality raw data. We sought to capitalize in a Technical Briefing report the lessons learned upon implementing BIA measurements on SAM children without edema participating in clinical trials in Burkina Faso, Liberia and Bangladesh.

Results: First, the BIA analyzer should measure resistance between 0-1700 Ohms and preferably operate on battery. Secondly, test the measurement and the quality scale on the target population and train the teams. Seek to identify tricks to relax and keep children calm and immobile during the measurement. Thirdly, prepare the material, calibrate the device and identify a calm and comfortable place to perform the measurement. Fourth, place the child on their back on a thin mattress, arms towards the lower body not touching the torso, lower limbs separated. Attach the electrodes making sure to leave a minimum of 3 cm distance from each other moving the receptive electrode up the arm or calf if necessary. Fifth, start the device, wait (maximum 2 minutes), note down the results and evaluate the quality of the measurement.

Conclusions: BIA is an easy body composition measurement suitable for operational research settings and relatively simple to adapt to different contexts and target populations. Five steps guide the user to obtain quality measurements. Research on appropriate SAM diagnosis, treatment effectiveness and its long-term consequences should systematically evaluate body composition as a necessary way to move beyond anthropometry and get to physiological information. This more detailed information could lead to the optimization of current treatment protocols.

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