WHAT IS THE PREDICTION MARKER™ AND HOW DOES IT HELP ME?

BIA Impedance Ratio

PREDICTION MARKER™
Introduction

Bioelectrical Impedance Analysis (BIA), technology began in the mid 1980s with single-frequency devices. These devices focused on the study of fat and fat-free mass. Since then, there have been many significant developments and technological advancements. Multi-frequency devices are now common place, from two frequency to Bioelectrical Impedance Spectroscopy (BIS) devices, offering up to 100 potential frequencies. We can now gain further insight of the body, particularly hydration status and fluid shifts. This advancement has many implications for the medical profession.

BIA is a technique to establish an individual’s body composition (refer to the model on the right). The subject, whilst in a supine position, has two electrodes attached to the right foot and the right hand. The electrodes are then connected by lead wires to a handheld device and a small electrical signal is passed through the body. The resistance and reactance to the current is measured in Ohms and the body composition breakdown is then calculated using a series of algorithms.

This brochure will explain how raw data, obtained from multi-frequency devices can be used to monitor intracellular (ICW), extracellular fluid (ECW) and total body water (TBW), hence cellular health and nutritional status.

The Prediction Marker is discussed in the ESPEN “Blue” Book, Basics in Clinical Nutrition text, as a “newer way to evaluate cell membrane function” and as a “reliable guide to prognosis” (of patients in intensive care units). The Prediction Marker is unique to Bodystat and since its inception has been used in many research areas.

The Prediction Marker or Impedance Ratio is the ratio between the impedance measurement at 200 kHz and 5 kHz. At 200 kHz the current is strong enough to penetrate the cell membrane and therefore total body water (TBW) can be measured. However, at 5 kHz the membrane cannot be penetrated and only Extracellular Water (ECW) can be measured. Intracellular water (ICW) is derived by TBW-ECW. The greater the variance between the two impedance values at 5 kHz and 200 kHz, the healthier the body cells. To allow easy monitoring of change, these figures are expressed as a ratio. A ratio closer to 1.00 indicates poor cellular health or extreme fluid overload. Figure 3 illustrates the normal ranges as experienced by Bodystat.

Figure 4 illustrates actual data of a “dying” male. Note that the curve is much flatter compared to that of the healthy male. When considering this data, the steeper the curve, the healthier the body cell.

Expansion of ECW and loss of ICW are typical features of systemic illness, arising from protein leakages into the extracellular space and loss of intracellular protein.

Loss of intracellular potassium and extracellular accumulation of sodium result in an increased whole-body exchangeable Na+–K+ ratio, which is a strong predictor of mortality in surgical patients. The resistance of the cell membrane at 5 kHz is therefore significantly reduced in the case of critical illness and the difference between the impedance values at 5 kHz and 200 kHz is markedly closer to each other resulting in a higher ratio, indicating cellular deterioration.

“ITS SIMPLICITY IS MOST ATTRACTIVE”

Figure 2

BIOELECTRICAL PROPERTIES

Figure 3

HEALTHY vs DYING MALE

Figure 4
To realise the full potential of the Prediction Marker, it should be tracked over a period of time. The ideal situation would be for the Prediction Marker to be taken prior to treatment and this figure to be used as a benchmark, then measured again during intervention, post-treatment and at follow-up appointments. By using this technique as a clinician you will be able to monitor the cellular health of the individual and to see the effectiveness of your intervention, be this drug therapy, surgery or nutrition. This tracking should be done at an interval to suit your requirements, which may be over a period of months, weeks, days or hours.

**BODY CELL MASS (BCM)**

The BCM (metabolic tissue and ICW) is a very important element of the study of body composition, as it is indicative of nutritional status (refer to the model on the second page). In omitting to monitor ICW and ECW shifts in the body composition and monitoring only the weight or BMI (Body Mass Index), declines in health may not be identified.

In other words, decreases in the BCM can be obscured by an expansion of ECW. Furthermore, BMI does not reflect nutritional status in ill patients, as the decrease in BCM is obscured by an expansion of ECW.
The development of oedema after major surgery is associated with increased morbidity. Oedema formation is related to fluid balance and clinical outcome. An important study revealed that the pre-operative ratio of whole body impedance at 200 kHz to that at 5 kHz was higher in those who subsequently developed oedema thus identifying patients at risk before surgery.

In the intensive care unit (ICU) impedance measurements can easily be made as frequently as deemed necessary without disturbance to a patient to monitor and track the changes in the ratio. An increasing ratio may indicate a potential deterioration in the clinical condition of a patient.

The Prediction Marker can also be used for segmental analysis. Once again, the clinician would track the deviation from the benchmark measure over a period of time.

The most important consideration is the placement of electrodes. Whether you are measuring the arm, leg, or trunk you must choose an anatomical marker which is easily found for accurate reproducible measurements. Popular applications for this method are lymphoedema, rehabilitation (of broken arm or leg), stroke and surgery and monitoring fluid shifts in the lungs.

Whole body assessment is a popular use of the Prediction Marker. It has been found, along with Phase Angle, to be a useful screening tool to assess both the nutritional risk of a patient and used as an independent predictor of outcome and mortality. Most importantly this can be used with bedbound patients as no height or weight is required.

Prediction Marker and Phase Angle are currently used throughout many different critical care environments, including, oncology, HIV, surgery, paediatrics, dialysis and critical care units.
PREDICTION MARKER™

(Impedance Ratio)

ANY: DISEASE STATE
ANY: AGE GROUP
ANY: POPULATION GROUP
ANY: GENDER
ANY: SEGMENT

+ Can be used in extremely oedematous patients where Phase Angle becomes obsolete*
+ Independent from gender, age, weight, height or population group
+ Can be used on children and infants
+ Easy to use with bedridden patients
+ Raw data, no equations
+ Proven early indicator of outcome
+ Provides a marker for cellular health
+ Whole body or segmental measurements
+ Monitor effectiveness of rehabilitation of leg or arm after prolonged non-use in plaster cast
+ Non-invasive
+ Quick to perform
+ Little or no training required.

* ESPEN13-1550
BIOIMPEDANCE ILLNESS MARKER COMPARED TO PHASE ANGLE AS A PREDICTOR OF MALNUTRITION IN HOSPITALISED PATIENTS
L. Plank, A. Li
Surgery, UNIVERSITY OF AUCKLAND, Auckland, New Zealand

Remember! The Prediction Marker provides an easily quantifiable value against which improvement can be measured.
“Impact of oedema on recovery after major abdominal surgery and potential value of multifrequency bioimpedance measurements”

E. Itobi, M. Stroud and M. Elia
Department of Surgery and Institute of Human Nutrition

“Preoperative ratio of whole-body impedance at 200 kHz to that at 5 kHz was higher in those who subsequently developed oedema. The present study has shown that BIA represents an additional bedside tool with the potential to identify and monitor patients who are susceptible to pathological fluid shifts after major surgery.”

“Low albumin levels and high impedance ratio as risk factors for worsening kidney function during hospitalization of decompensated heart failure patients”

Lilia Castillo-Martinez PhD, et al.
Heart Failure Clinic at Instituto Nacional de Ciencias Medicas y Nutricion “Salvador Zubiran”, Mexico City, Mexico

We recommend the impedance ratio to be part of routine examination of the patients with DHF.

Exp Clin Cardiol Vol 18 No 2 2013

“In this patient group, IM {PM} was a more sensitive indicator of malnutrition than PA and may have application in bedside assessment of nutritional status.”

Presentation ESPEN Congress 2013 – PP166-SUN

“Bioimpedance Illness (Prediction) Marker Compared to Phase Angle as a Predictor of Malnutrition in Hospitalised Patients”

Lindsay D Plank, et al.
Department of Surgery, The University of Auckland, New Zealand

More medical research papers at: www.bodystat.com
ABOUT BODYSTAT

Bodystat Ltd, based on the Isle of Man (British Isles), has been established since 1990 and is a registered ISO 13485:2003 company. We specialise solely in BIA Technology and are dedicated to expanding the knowledge of this to improve health and well-being. We have an extensive range of research papers (available on our website) dedicated solely as non-commercial, free materials for educators.

Our devices are manufactured in Europe, made to the highest specifications and use only the best electrical components. The high quality of our devices ensures accurate results that are both reproducible and reliable.

Bodystat Limited
Ballakaap • Ballafletcher Road
Cronkbourne • Douglas
Isle of Man • IM4 4QJ • British Isles

Tel: +44 (0) 1624 629571
Fax: +44 (0) 1624 611544
Email: info@bodystat.com
Web: www.bodystat.com

Download free research papers from our website: www.bodystat.com