

## Bioimpedance Analysis Explained

Bioimpedance Analysis (BIA) is a diagnostic tool used to obtain objective data regarding your health status as well as monitor how your health is evolving. This test produces accurate data with little time and effort. We all need objective data to gauge whether or not a fiber diet, lifestyle, nutritional protocol, or medication is working for you. We all need to be motivated, and this kind of information is motivational. This is a scientifically validated procedure with over 2000 published research studies that have used this technology.

The bioimpedance analyzer is an FDA approved electronic device which applies a small 50-kilohertz current through the body using sensor pad electrodes which are placed on the right foot and right wrist. Within 10 seconds after entering your height, weight, sex, and amount you perform exercise in a week, valuable information is at our fingertips regarding your biological health.

This data then provides a clinical assessment of body composition which includes fat mass, lean body mass, body cell mass, extracellular mass, total body water, intracellular water, extracellular water, basal metabolic rate, and phase angle. Phase angle is a "buzz word" indicating cellular health and integrity. Within the last few years there have been several published papers in major journals depicting phase angle as the best indicator for prognosis of survival for patients with cancer, AIDS, and kidney disease. This is the number most athletes are interested in. A normal distribution of tissue and fluid in the body is associated with immunity, high function, and longevity. An abnormal distribution of tissue and fluid in the body is associated with susceptibility, effects of disease and aging, low function, morbidity, and mortality.

Specific areas where body composition information can be applied include Nutritional Assessment, Anti-aging Therapy, Physical Performance Assessment, Weight Management, Obesity, Eating Disorders, HIV/AIDS, Diabetes Fluid Analysis, Dialysis Fluid and Nutritional Assessment, Critical Care Monitoring, Geriatrics, Lifestyles Assessment, Athletic Performance, Clinical Trials, and Research Initiatives.

According to an article published in JAMA by Dr. Roubenoff, "Muscle is the major source of protein for functions such as antibody production, wound healing, and white blood cell production during illness. If the body's protein reserves are already depleted by sarcopenia (muscle loss), there is less to mobilize for illness." We all want more vitality and functional capacity for as long as we can have it. We all want more metabolically active tissue (lean body mass) and less metabolically inactive tissue (fat mass). We all want our cells to be like plump, juicy grapes as opposed to dried out raisins. Our goal is a first line therapy approach implementing lifestyle modifications accompanied by a nutritional program that can offset biochemical imbalances, environmental assaults, and keep our cells happy. This is our focus and goal for you.

**What is Body Mass Index (BMI) ?** This is a ratio between weight and height. It is a mathematical formula that correlates somewhat with body fat. If your BMI is high, you may have an increased risk of developing certain diseases, including:

- \* Hypertension
- \* Cardiovascular Disease
- \* Dyslipidemia
- \* Adult-Onset Diabetes (Type II)
- \* Sleep Apnea
- \* Osteoarthritis
- \* Female Infertility

### **Exceptions to BMI**

BMI is a better predictor of disease risk than body weight alone. However, there are certain people who should not use BMI as the basis for estimating body fat content: competitive athletes and body builders, whose BMI is high due to a relatively larger amount of muscle, and women who are pregnant or lactating. Nor is it intended for use in growing children or in frail and sedentary elderly individuals. Prevention of further weight gain is important and weight reduction is desirable.

### **What Is Basal Metabolic Rate (BMR) ?**

This is the amount of energy you would require if you laid in bed all day without ever moving a single muscle. Since most of us do a bit more than that, a daily activity level must also be factored in. This ranges from everyday activities to working out strenuously every day.

Energy is the most fundamental need of biological systems. Without it, the basic biological processes of life cannot occur. Survival depends on consistently finding the right fuel in the appropriate quantity to sustain the biochemical reactions of energy metabolism. The body extracts and uses energy through the process of metabolism. Metabolism occurs in two distinct and interdependent phases: 1.) catabolism, in which the body breaks down food into its component parts and harvests the energy stored in its atomic bonds, and 2.) anabolism, in which those component parts and energy are used to build new tissues and conduct basic life functions. Basal Metabolic Rate (BMR) is the amount of energy your body requires every day to perform its most basic function including:

1. breathing
2. digesting
3. heart beating
5. muscles activity
- 6 transportation of fluids and tissue
7. circulation of blood

BMR is only a way to estimate how fast you burn calories. The slower your metabolism, the more weight you will retain. If you burn your daily calorie intake, you will maintain your current weight. Burning more than your daily intake causes weight loss. There are many factors that vary your metabolism. However, exercise and daily activity level are key to increasing your BMR. There can be major nutritional consequences to the decline of the BMR in advanced age. Decreased caloric requirements may lead to decreased food intake.

Sufficiently low caloric intake can lead to deficient intake of essential nutrients. The more lean tissue, specifically body cell mass, the higher your BMR.

BMR varies between the sexes. Lean body mass is a major determinant, and women tend to have less lean muscle mass. As a result, their BMR is lower than that of otherwise comparable males.

BMR is at peak during infancy, then it declines rapidly through childhood and adolescence. It continues to fall slowly with increasing age and decline further with old age due largely to a loss of muscle mass. This is not inevitable, because of inactivity, weight-bearing exercise will prevent or reverse muscle loss among the elderly.

### **What is Phase Angle ?**

Phase angle is based on total body resistance and reactance and is independent of height, weight and body fat. Lower phase angles appear to be consistent with either cell death or a breakdown of the cell membrane. Higher phase angles appear to be consistent large quantities of intact cell membranes and body cell mass. All living substances have a phase angle. In fresh uncooked vegetables phase angle can exceed 45 degrees. In cooked vegetables phase angle is zero because they are dead.

Phase Angle is a predictor of outcome and indicates the course of disease, it increases as the result of optimal health based on good nutrition and consistent exercise. As we get older our phase angle will decrease and will be approximately 4 or less when we die. Fit adolescents may have a phase angle greater than 10. This effect is a result of cell integrity due to age. Low phase angles are consistent with:

- \* Malnutrition
- \* HIV/AIDS infection
- \* Cancer (most types)
- \* Abusive life style
- \* Chronic Alcoholism
- \* Old Age (80 - 100 years)

Good fitness and life style is the key to maintaining a healthy phase angle. Phase angle is a good indicator of disease progression although it is not used to diagnose a specific disease. It may be thought of as a thermometer with a broad range of normal. It may also be used to monitor the practice of good health which would include healthy diets, the use of nutritional supplements, and exercise.

### **What is Impedance Index ?**

IMP INDX stands for "Impedance Index". Impedance index is a straight line or constant that discriminates healthy subjects from those that are less healthy. A healthy person who has a large amount of Body Cell Mass (such as a bodybuilder) will have a very high impedance index. A person who is older and sedentary will have a lower impedance index.

## What is Capacitance ?

All living things are made of cells. Cells are membrane bounded compartments filled with a concentrated solution of chemicals and salts. Groups of cells perform specialized functions and are linked by an intricate communications system. The cell membrane maintains an ion concentration gradient between the intracellular and extracellular spaces. This gradient creates an electrical potential difference across the membrane which is essential to cell survival. Electrical gradients are necessary to support movement of oxygen, carbon dioxide, and nutrients. Therefore, the cell membrane has electrically insulating qualities or capacitance.

Electrical capacitance will increase or decrease depending on the health and the number of cells. Damage to the cell membrane, and its functions, is as lethal to the cell as direct damage to the nucleus itself.

The cell membrane functions as a permeable barrier separating the intracellular (cytoplasm) and extracellular components. The lipid membrane is transversed by proteins, which are soluble in water thus making pores through which water, ions and other chemicals can enter and exit the cell. BIA prediction equations have been developed that use parallel resistance and reactance as predictors of extracellular mass and body cell mass. Comparisons to K40, DEXA and D20 were very good ( $r > .9$ ) and are sufficient to be used in clinical practice and studies of wasting disorders in AIDS patients.[1]

Parallel capacitance is somewhat like phase angle, whereas it is not affected by weight or body fat. It is a measure of cell membrane health in all living substances and can change dramatically depending on disease or good health.

A body builder, for example, would have a high parallel capacitance and low resistance, or more cell volume, because he is extremely muscular and fit. A malnourished AIDS patient would have a low parallel capacitance.

## BIA Key Measurements

#1 Phase Angle is the most important measurement. It indicates the cell membranes health. Higher is better.

Men: 6.7-12.9      Women: 4.6-10.9

#2 Body Capacitance is the cell membranes ability to hold an electrical charge. Higher is better

#3 ICW or Intracellular Water Nutrition Status. A healthy cell can maintain high levels of water. Higher is better:

Men 55-57%      Women: 53-55%

#4 ECW or Extracellular Water Nutrition Status. A healthy body has low levels of water outside the cell. This is also known as the Toxin status. Less is best. Men: 45 - 43% Women: 47 -45%

#5 Muscle Cells Metabolically active cells are the #1 Biomarkers of Aging. More is better.

#6 Fat Cells these are metabolically inactive cells and they are the #4 Biomarker of Aging less is better.

#7 Lean Body Mass Contains all of the Fat Free tissues; water, muscle, bone, connective tissue and internal organs.

#8 BMI Body Mass Index. The ratio of weight to height.

#9 BMR Basal Metabolic Rate the rate in which the body burns energy (calories) during a normal resting state, over 24 hours.

#10 Impedance. Normal value for Impedance index are 1273 and above.

Anything below 1273 would Indicate a decline in health.

How Can I Improve My Scores?

1. Increase the following nutrients:

- Essential Fatty Acids
- Antioxidants
- Multiple Vitamin / Mineral

2. Detoxification Management

3. Body Composition Management

4. Increase Water Intake

5. Exercise

6. Chiropractic Adjustments to stimulate and normalize nerve activity.

References:

[1] Donald P Kotler, S. Burastero, J. Wang, R. N. Pierson Jr. "Prediction of body cell mass, fat-free mass, and total body water with bioelectrical impedance analysis: effects of race, sex, and disease" Am. J. of Clinical Nutrition 64:3 Sep 1996.

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