**THE FUTURE OF PATIENT MONITORING**

**A COMPLETE CLINICAL ASSESSMENT**

**ABSOLUTE MEASUREMENTS**
Absolute measurements have been highly correlated to changes in the human body and have been shown to be good indicators in predicting mortality.

**DRY WEIGHT**
Under and over estimation of dry weight is important and has been shown to impair the survival and quality of life of haemodialysis patients.

**BODY COMPOSITION**
Nutritional assessment of children and adults in clinical and field settings is important in order to identify potential causes of inadequate nutrition status, including the risk of malnutrition. Performing nutritional assessments in diseased patients enable medics to identify related disorders and to monitor the effects of any treatment.

**GFR**
An important indicator of Kidney function. A rate at which waste is removed from our kidneys. High correlation was found using BioScan 916 in the estimation of GFR, avoiding the necessity of 24 hour urine collection or calculating using CC or MDRD formulas.

**GLYCOGEN MASS**
The primary storage form of carbohydrates found in the cytoplasma of most cells.

**MINERALS AND PROTEIN**
Bone, soft tissue and protein content of the body. Inorganic compounds containing an abundance of metals. In clinical patients the assessment of the loss of minerals is important.

**FLUID STATUS**
Intracellular & Extracellular body fluids in both healthy and diseased patients is of significant importance. Extracellular Water (ECW) increases in different diseases and oedema is the most common sign of ECW expansion. Monitoring these changes in patients can provide us with detailed information and understanding of changes as a result of disease.

**CREATININE**
Creatinine estimations can be performed using the BioScan 916, avoiding 24 hour urine collections.

**BCM**
Body Cell Mass is an accurate method of establishing a healthy subject's nutritional status or a patient's degree of malnutrition. BCM is used for normalisation of energy expenditure and other metabolic measures.

**BIOSCAN 916 RESULTS DISPLAYED**

- Impedance
- Phase Angle
- Resistance
- Reactance
- Capacitance
- Dry Weight
- Fat %
- Fat Mass
- Fat Free Mass
- Fat Free Mass %
- Body Volume
- Body Density
- Body Mass Index
- Resting Metabolic Rate
- Target Fat (min / max) %
- Target Weight (min / max)
- Target Water (min / max) %
- Glomerular Filtration Rate
- Total Body Potassium
- Total Body Calcium
- Protein Mass
- Mineral Mass
- Glycogen Mass
- Extracellular Fluid
- Intracellular Water Volume
- Extracellular Water Volume
- Extracellular Water Lt
- Total Body Water Volume
- Intracellular Water Lt
- Intracellular Water %
- Extracellular Water %
- Total Body Water Lt
- Total Body Water %
- Extracellular Mass
- Extracellular Solids
- Extracellular / Intracellular Water
- Extracellular Water / Total Body Water
- Intracellular Water / Total Body Water
- Interstitial-Fluid Extravascular
- Plasma-Fluid (Intravascular)
- Creatinine
- Body Cell Mass
- Muscle Mass
Maltron Instruments use scientific method of measuring Bioelectrical Impedance. A total of four electrodes are used (tetrapolar). 2 electrodes are applied to the hand and two to the foot. A low-level battery current is passed through the body and the absolute measurement of impedance, phase, resistance, reactance and capacitance are made.

Using the measured raw data, Maltron Instruments perform a complete analysis in less than 5 seconds.

Displaying parameters such as Extracellular and Intracellular fluids, Total Body Water, Fat and Fat Free Mass, Dry Weight and many others including mineral composition (BioScan 916 range only).

The patient information is provided without the need of complex clinical techniques like radioisotope dilution.

Our bodies undergo changes with age, monitoring these alterations is important, even though assessing them is often more difficult and problematic.

Body weight and BMI have been shown to be inadequate indicators for monitoring these changes.

These variables do not show the amount of Fat Mass (FM) or Fat Free Mass (FFM).

Therefore Nutritional assessment of children and adults in hospital and field settings is essential in order to identify potential causes of inadequate nutrition status, including the risk of malnutrition.

Performing these measurements in diseased patients enables medics to identify related disorders and to monitor the effects of any treatment.

BioScan 916 stores 100 patients’ results and the USB interface enables downloading of the measured data directly into the PC using the fast high speed USB.

The future of impedance analysis used in monitoring body composition, nutrition, hydration and mineral assessments in diverse clinical settings.
Maltron Analysers provide us with important information regarding change in body composition during growth, ageing and disease.

Detailed information can be obtained in the areas of nutrition, intracellular and extracellular body fluids.

Extracellular water (ECW) increases in different diseases and oedema is often the most common sign of ECW expansion. Although these changes in fluid compartments have a clinical significance, no method has been put in place to detect and monitor these changes. Moreover, Intracellular water (ICW) also changes especially in early stages of heart failure, liver cirrhosis and chronic renal failure.

Body composition assessments have been performed in several clinical areas using BioScan on patients with fluid retention, malnutrition, Diabetes, eating disorders and Obesity. Other areas in which BioScan has been found to be an indispensable tool is in the estimation of Dry weight, Surgery, in Cardiovascular patients, Gastroenterology, HIV, Paediatrics, Endocrine and metabolic disorders, Cystic Fibrosis, during pregnancy, on the elderly and many more.

Cystic fibrosis patients tend to lose body weight and lean body tissues because of muscle wasting and depletion of bone mineral. Monitoring in this group of patients enables clinicians to provide nutritional support to counter these disease effects.

Assessing fat and regional fat distribution is important in patients with cardiopulmonary diseases such as chronic heart failure, pulmonary disease and chronic obstructive pulmonary disease.

Obesity has been identified as a risk factor which is associated with not only CAD but also related diseases like hypertension and many others.

At the other extreme, Coronary Artery Disease (CAD) patients tend to be overweight or obese.

Heart lung transplant patients taking immunosuppressant drugs after surgery, typically gain weight due to an increase in Fat Mass (FM).

Measuring these changes in clinical settings is of significant importance.
Cell membranes cause time delays compared to time taken passing through extracellular water. The greater the number of cell membranes the signal has to pass through, the longer the time delay.

This time delay can be compared to the period of the signal frequency. The higher the phase angle, the greater the proportion of ICW compared to ECW.

Body Cell Mass (BCM) is the most active metabolizing portion of the body and from clinical perspective, one of the most important components of body composition. TBK has been found to be linearly correlated with BCM, therefore BCM can be derived from direct body capacitance using BioScan.

BioScan Phase measurement has been found to be an important indicator of mortality and modality. Phase angle is the relationship between resistance and reactance. 0 degrees is an indicator of no cell membranes and 90 degrees is a capacitive circuit which consists of all membranes with no fluid.

A healthy individual will have a phase angle of 4 to 15 degrees. A lower phase angle is associated with cell death or breakdown in the selective permeability of the cell membrane. High phase is consistent with high reactance and a large amount of waste cell membrane and body cell mass (BCM).

Capacitance, in electrical terms, is the storage of an electrical charge by a condenser for a short moment in time. Capacitance measurements in a living substance, are an indicator of healthy cell membrane. Depending on the health and the number of cells, the electrical capacitance will increase or decrease. Each person consists of many cells, which are integrated to perform complex functions necessary for life.

BioScan Phase measurement displaying in excess of 42 parameters including Intracellular and extracellular fluids status, Body Cell Mass, Dry weight, Mineral composition, GFR and Body composition.
While Total Body Water (TBW) provides some information about changes, additional important information can be obtained from the measurement of Fat Free Mass hydration (FFMH = TBW / FFM). TBW is divided into Extracellular (ECW) and Intracellular water (ICW). Extracellular can be further subdivided into interstitial (IW), Lymphatic (LW), trans-cellular (TCW) and Blood (BIW). Although BIW can be measured directly, comparatively it provides very little information to the clinician other than extracellular hydration.

One compartment measurement
Usually refers to the measurement of body weight. Although a good indicator of change in total body weight, we are unable to identify the cause of the change with this method of assessment.

Two compartment measurement
Using the hydrodensitometry (underwater weighing) the human body is divided into fat and fat free mass. Densitometry is mainly suitable for research and not for bedside or everyday use. Other techniques such as infra-red interactance and anthropometry, although not identical methods, are similar.

Three compartment measurement
Due to the intraindividual variability of fluids, a three compartment model was developed which divides the body into fat, water and solids (protein and mineral are a fraction of fat free body mass).

Four compartment measurement
Divides the body into fat, water, mineral and protein components. BioScan absolute measurement of phase allows the Impedance (Z) element to be separated into an additional 2 compartments, Resistance (R) (water) and Reactance (Xc) (cells). This enables assessment to be made between body cell mass, extracellular and intracellular mass.

PERCENTAGE BODY FAT LEVELS FOR CHILDREN AND ADULTS

<table>
<thead>
<tr>
<th></th>
<th>MID</th>
<th>MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>MALES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-17</td>
<td>11</td>
<td>26</td>
</tr>
<tr>
<td>18-34</td>
<td>13</td>
<td>22</td>
</tr>
<tr>
<td>35-55</td>
<td>18</td>
<td>25</td>
</tr>
<tr>
<td>55 +</td>
<td>16</td>
<td>23</td>
</tr>
<tr>
<td>FEMALES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-17</td>
<td>16</td>
<td>31</td>
</tr>
<tr>
<td>18-34</td>
<td>28</td>
<td>35</td>
</tr>
<tr>
<td>35-55</td>
<td>32</td>
<td>38</td>
</tr>
<tr>
<td>55 +</td>
<td>30</td>
<td>35</td>
</tr>
</tbody>
</table>
Some of the different effects of diseases on body composition

- Loss or low Body Fat
- Excessive weight gain
- Loss of body weight
- Loss of Fat Free Mass
- Low muscle tissue
- Loss or low Bone mineral
- Loss of Body Cell Mass
- Malnourished
- Stunted growth
- Delay onset of puberty
- High Body density
- Fluid in balance
- Oedema
- Altered fluid status - Total body water, Extracellular and Intracellular fluids
- Decrease in Intracellular
  (associated with Body Cell Mass and Potassium)
- Increase in Extracellular Water symptomatic of oedema
- Plasma volume increases and fluid accumulates in the lungs, abdominal organs and peripheral tissues.
- Changes in Water, Mineral and Protein contents
- Muscle wasting in clinical patients (Cachexia wasting syndrome)
- Higher Bone Mass and Mineral density
- Reduce Lean Trunk mass

Complex changes occur in body composition during illness, monitoring these biological changes can provide us clear insight for early diagnosis and treatment.

Some of the clinical benefits:

Cardiopulmonary diseased patients with Cystic fibrosis, Chronic Obstructive pulmonary disease and Chronic heart failure lose body weight, and lean tissue due to muscle wasting and depletion of bone mineral, this effects body composition.

Body Cell Mass has been found to be a better indicator of survival than weight loss, in patients with wasting diseases and disorders like Cancer, Kidney and Dialysis, Liver diseases and Cirrhosis, Anorexia Nervosa, Muscular dystrophy, Multiple sclerosis, Spinal cord injury, HIV and Aids. Assessment can help clinicians identify BCM loss and monitor the efficiency of clinical intervention.

In patients with metabolic diseases such as Diabetes, Obesity and Thyroid diseases, there is a direct effect on fat, protein, minerals and carbohydrate thus increasing or decreasing body weight, resulting in an alteration of body composition.
percentage calculated with Siri’s formula is an overestimation.

54, 471-477.


56, 651-666.


57, 263-273.

Skinfold on right and left sides: held by one or two hands.

Nutrition, 31, 769-773.


Deurenberg, P., van der Kooy, K., Leenen, R., Deurenberg, P., 

75, 977-985.


Kuczmarski, R.J., Regal, K.M., Campbell, S.M., 


Technical Specifications

<table>
<thead>
<tr>
<th>BioScan 915 - 916 - 916S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technique:</td>
</tr>
<tr>
<td>Frequency:</td>
</tr>
<tr>
<td>Resolution:</td>
</tr>
<tr>
<td>Impedance Range:</td>
</tr>
<tr>
<td>Resolution:</td>
</tr>
<tr>
<td>Accuracy:</td>
</tr>
<tr>
<td>Phase range:</td>
</tr>
<tr>
<td>Resolution:</td>
</tr>
<tr>
<td>Accuracy:</td>
</tr>
<tr>
<td>Resistance range:</td>
</tr>
<tr>
<td>Resolution:</td>
</tr>
<tr>
<td>Reactance Range:</td>
</tr>
<tr>
<td>Resolution:</td>
</tr>
<tr>
<td>BioScan 916 Estimation of</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Printer Interface</td>
</tr>
<tr>
<td>Ambient Temperature</td>
</tr>
<tr>
<td>Relative Humidity</td>
</tr>
<tr>
<td>Atmospheric Pressure</td>
</tr>
<tr>
<td>Test Current:</td>
</tr>
<tr>
<td>Power:</td>
</tr>
<tr>
<td>Battery Current:</td>
</tr>
<tr>
<td>Weight:</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Dimensions:</td>
</tr>
<tr>
<td>Service:</td>
</tr>
<tr>
<td>Guarantee:</td>
</tr>
</tbody>
</table>

This device is manufactured to conform with EEC Medical Devices Directive.

ISO 9001 REGISTERED COMPANY
EN46001 REGISTERED COMPANY

Maltron reserves the right to make design changes without notice as part of our continuous programme of product development. Maltron and Maltron logo are Registered Trademark of Maltron International Limited. Maltron shall not be liable for any editorial or technical errors omitted. Copyright 1999. Maltron International. All rights reserved. V09/11/04