

**FAT MASS ESTIMATION BY  
BIOELECTRICAL IMPEDANCE ANALYSIS**

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**Epidemiological studies have shown that relative risk of diabetes and cardiovascular diseases was higher in those with abdominal adiposity which is a part of metabolic syndrome**

**In recent years bioelectrical impedance measurement has been widely used in clinical settings for assessment of total fat as well as its distribution**

**Bioelectrical impedance analysis (BIA) determines the electrical impedance, or opposition to the flow of an electric current through body tissues which can then be used to estimate total body water, fat-free mass and, body fat.**

**Most of these machines have been developed in the developed countries and have been used for fat mass measurements in different settings or by athletes for measuring muscle mass and changes in muscle mass in response to training.**

**The subjects used during development of these machines are mostly Caucasians.**

**First body composition is measured using the gold standard method (eg doubly labelled water, underwater weighing).**

**Then the BIA measurements are taken in these subjects.**

**A variety of sophisticated mathematical equations are derived based on which the fat mass, fat free mass, body water can be computed from the impedance offered to electric current.**

**These are validated in other subjects using gold standard methods for comparison.**

**Ideally the BIA results should be compared with the results from a gold standard method based computation of body composition, before it is used. However the gold standard methods are accessible only in selected research laboratories and therefore cannot be widely used.**

**Indians have higher body fat for given BMI and so their body composition differs from Caucasians.**

**Some manufacturers state that they have attempted to change the mathematical equations to suit the South Asian body composition**

**All commercial models of the machines have inbuilt mechanism which measure bioelectrical impedance, compute and display body composition measurements on the screen**

**The method has become popular for estimating body fat because equipment is relatively inexpensive, portable and easy to use.**

**Consumption of water, dehydration, or moderate physical activity can all lead to inaccuracy in body fat estimation using BIA.**

**The newer 8 electrode machines can be used**

- by well trained personnel who are aware of the precautions to be taken**
- in aware persons who had been informed and have taken the precautions**
  - To assess body fat and its distribution in the individuals**
  - To monitor changes in body fat over time in an individual who ensures comparable conditions between visits**

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The newer versions of the BIA machines have

- a platform (with four electrodes) on which the person comfortably stands
- two hand held electrodes
- a small key board which can be used to choose required measurement
- a small screen which displays the measurements

Measurements can be printed by connecting to a printer.



# FAT MASS ESTIMATION BY BIOELECTRICAL IMPEDANCE ANALYSIS

Body wt 38.8 Kg Body fat 26.3% Fat mass 10.2 kg



## Segmental fat distribution

Truncal fat 25.4%

Lt arm	23.0%	Rt arm	21.3%
Lt leg	28.4 %	Rt leg	28.4 %

# VISCERAL FAT ESTIMATION BY BIOELECTRICAL IMPEDANCE ANALYSIS



**Weight 38.8 kg**  
**Visceral fat 1 (normal range 1-12)**



# FAT FREE MASS ESTIMATION BY BIOELECTRICAL IMPEDANCE ANALYSIS



Weight 38.8 kg

Fat free mass 70.1%

Fat free mass 27.2 kg



## Segmental distribution of Fat free mass

Trunk 14.1 Kg

Lt arm 1.0 kg Rt arm 1.0 kg

Lt leg 5.5 kg Rt leg 5.6 kg



# BODY WATER ESTIMATION BY BIOELECTRICAL IMPEDANCE ANALYSIS



<b>Weight</b>	<b>38.8 kg</b>
<b>Body water</b>	<b>51.5 %</b>
<b>Body water</b>	<b>20.0 kg</b>