ASSESSMENT OF BODY COMPOSITION

Assessment of body composition (BC), especially fat and fat free mass (FFM) plays a very crucial role in assessing health related condition in an individual. Hence BC provides clear information of percentage of fat, bone mass, water content and muscle volume in an individual.

The different techniques used for the assessment of body composition parameters are given as follows: densitometry, plethysmography, isotope dilution, whole body ^{40}K counting, anthropometric, bioelectrical impedance analysis, ultrasound, DEXA, CT, MRI and thermal imaging.

Anthropometric measurement

BMI

Waist and hip circumference

Skin fold thickness

Skin fold thickness measurement technique is a classical method to measure the subcutaneous fat fold in an individual. Since fat has a known density, the total and regional fat can be estimated on summing up the measurement of subcutaneous fat thickness across the region of interest (ROI). This technique is mainly used to assess subcutaneous fat at different ROI. Population specific equations are utilized in determining the percentage of body fat at specific region

The skinfold caliper helps in measuring the subcutaneous fat thickness at specific site of interest. The measurements were performed at nine standardized anatomical sites of the body namely, chest, mid- axillary, flank, abdominal, quadriceps, triceps, biceps, subscapular and medial calf. N

Bioelectrical impedance analysis (BIA)

BIA determines the electrical impedance which is further used to calculate TBW which is then used to measure FFM. Also, total body fat can be calculated by subtracting the fat free mass from total body weight

In this technique the subjects body is modelled into a five level cylindrical compartments which include the trunk and four limbs while the fat in the body act as an insulator which makes a closed circuit

Since fat mass has a much lower concentration of water in its tissue (about 10% water), it becomes poor conductor and lowers the signal from one point to another and as a result, high resistance is obtained. On the other hand, FFM tends to have higher concentration of water (20-75% water, muscle contains 75%), resulting in

a lower resistance value. Therefore, higher resistance shows the presence of high fat mass and lower resistance shows the presence of FFM in the body which is then calculated by the system to obtain the physical values

Ultrasound studies

DEXA

The lean tissue mass, total body fat, regional body fat and bone density were measured using the whole body dual x-ray absorptiometry (DEXA). The instrumentation of DEXA includes a source that initiates x rays at two different energies and a detector.

Computed tomography (CT)

CT technique is considered as a standard procedure to determine BC in an individual. The computed tomography has the ability to differentiate adipose and non-adipose fat tissue

The whole abdominal region from the T10 - T11 to L4 - L5 disc site of the lumbar vertebrae is selected for the CT imaging.

Magnetic resonance imaging (MRI)

The principle behind the MRI imaging was based on the magnetic property of hydrogen nuclei in water and fat which is present in the body cell to produce the soft tissue images of the whole body. MRI is used to estimate the volume of fat rather than the mass of subcutaneous adipose tissue and visceral fat tissue

Thermal imaging

Thermal camera uses infrared imaging for the measurement and visualisation of the thermal energy which are continuously emitted by the object to the surrounding.

Other techniques example

Hydrostatic weighing (Densitometry)

Hydrostatic weighing is also known as densitometry as well as underwater weighing. In this technique the body's density is measured by obtaining the difference of body weight in air and under water using Archimedes principle. The methodology includes measuring the weight of the subject (WS) and density of tank water (WD). Then the subject is made to sit on a specialised scale and submerged into a large tank of water. Next, the subject is asked to expel all the

air from their lungs and the residual volume (RV) and the weight of the subject under the water (WSU) is obtained. Then the density of the subject body is calculated using equation (1). Once the body density is obtained, body fat percentage can be calculated by utilising equation (2) [7]. Body density = WS / [(WS - WSU) / WD – RV] (1) Body fat percentage = [495 / body density) – 4.142] * 100

References

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