MODERN TRENDS FOR FAT ASSESSMENT

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This study focuses on modern trends for fat assessment techniques which are frequently used in assessment of fat. Our study consist of six fat assessment techniques (Caliper body fat testing, Hydrostatic body fat testing, Bio-impedance body fat testing, Infrared interactance, Bod pod body fat testing, Duel energy x-ray absorptiometry body fat testing). After a deep study of available literature we pointed out most accurate technique and widely used as per the need of an individual. Dexa scan is accurate technique but with certain limitation in practicability, whereas skin fold measurement technique is widely use technique detail discussion done on advantages and disadvantage of modern fat assessment techniques.

Keywords: Caliper, Hydro-Densitometry, Hydrostatic and X-Ray.

Introduction

People often measure their fitness progress on the scale, but that is not always the most reliable indicator. Your body weight consists of your organs, bones, muscle tissue, water, waste and fat. Knowing what percentage of your body weight is made up of fat is a better indication of health. Scientists have a variety of ways to determine body-fat percentage. Some are highly accurate but require sophisticated equipment. Others are more of an approximation but can be done in your home with a few tools. Body composition assessment and determination of the amount and distribution of body fat, respectively, from an essential part of the basic clinical assessment of an obese patient. However, there are no recommended methods to determine the amount of fat in obese population. (Verovská R, et.al2009) Accurate and precise assessment methods that are sensitive enough to track small changes in body compartments are essential for assessing the effects of intervention programs designed to alter body weight and composition. Various component and multi component models have been used to estimate body composition. Two-component chemical models divide the body constituents into fat mass (FM) and fat-free mass (FFM) and use classic measurement techniques to estimate body composition, including the well-established techniques of hydro densitometry and hydrometry. Dual-energy X-ray absorptiometry (DXA) is a relatively new method for measuring body composition.

Since the health, risks of being overweight are mostly related to excess fat, many people think they should check how much body fat they have. Technology to estimate body fat levels has now become readily available. With the numbers you get, which are only estimates of your actual body fat, you can roughly chart your progress reducing excess fat.

Excess weight from body fat can damage knees and hips. It also produces hormonal and metabolic changes that increase the risk of diabetes, heart disease and several forms of cancer. Body Mass Index, known as BMI, is a way of expressing weight that can predict a person's risk for all of these diseases. BMI is a good tool for most adults, but it can encourage people with more muscle or heavy bones to lose weight unnecessarily. It's also inappropriate for those who are elderly or who have lost a lot of muscle.

Fat Assessment Techniques

Caliper Body Fat Testing

This is a small pinching device that measures subcutaneous body fat on your body. It has a +/- 3-8 percent error ratio based on technician skill, quality of caliper used, and number of sites pinched. Although it's quick and relatively easy to get it's more of an estimate of body fat this is because it only measures a few areas on your body and not the whole thing. In addition, it is very subjective to each person that does the testing.

Advantages

- Easy to use once skill is mastered.
- Does not require much time.
- Inexpensive way of estimating body fat percent.
- Portable.

Disadvantages

- Mostly concerned with subcutaneous fat.
- Reliability is highly dependent upon skill, consistency of test location, and the type of calipers used.

Hydrostatic Body Fat Testing (Hydro-Densitometry)

According to research, "Hydrostatic Body Fat Testing "is still the "Gold Standard" to which all methods of body fat testing still compare them. However, the test is somewhat subjective because it relies upon the subject's ability to expel all oxygen from their lungs while submerged in a tank of water. Oxygen remaining in the lungs will skew the results. In clinical settings, this procedure is repeated a number of times, and an average is taken.

Advantages
- The "Gold Standard" in body fat testing.
- Fast test time (5-10 minutes)
- Most accurate technology.
- Provides the best repeatability from test to test (tracking changes)
- Error rate around 1.5%
- Low equipment maintenance
- Has been the most accurate method for over 30 years

Disadvantages
- Requires knowledge to administer test.
- Must be able to blow out your air.
- Does not necessarily take into account bone density / structure; merely water displacement.
- Requires certain specialized equipment.

Bio-Impedance (BIA) Body Fat Testing:

This measurement is done by hooking up an electrode to your foot or hand. An electrical low voltage impulse is then shot up one leg or arm and down the other to estimate body fat percentage. It measures the resistance in your body. Since body fat is a poor conductor of electricity, a lot of body fat will impede the current more so then lean mass. This grouping includes both Tanita AND Omron testing devices.

Advantages
- Fast and simple
- Convenient

Disadvantage
- Error ratio +/-5 to 8 percent
- Results affected by hydration levels, food intake, and body temperature.
- Subjectivity is high.
- Overestimates lean people and underestimates obese people.

Infrared Interactance

This method uses the principles of light absorption and reflection to measure body fat. The measurement is taken on the person's dominant arm. A monochromator, or light "wand", sends a low-energy beam of near-infrared light into the biceps and penetrates the underlying tissue to a depth of one centimeter. The energy is either reflected, absorbed, or transmitted, depending on the scattering and absorption properties of the biceps. A detector within the wand measures the intensity of the re-emitted light. Shifts in the wavelength of the reflected beam and a prediction equation are used to compute the percent body fat.

Advantages
- It is safe.
- The equipment is portable and lightweight.
- It requires little training to use.

Disadvantages
- This technique still lacks validation in humans.
- May not accurately predict body fat across a broad range of fat levels.
- It assumes fat is the arm is proportional to total body fat, which may not be true.
- Bod Pod Body Fat Testing:

This method tries to compare itself to the Hydrostatic method of body fat testing and it is based on similar principles. However, instead of using water it uses air displacement instead. This method has conflicting research reported on its results. Humidity, temperature, body hair and other environmental issues have been reported to negate the results of its body fat readings. According to Georgia State University, if each body fat test is performed correctly to the recommended guidelines, there is a +/-3% error. Likewise, a study done by McCrory, etal.* the bod pod has a validity of .93 using hydrostatic weighing as the criterion measure body fat percentage. (Medicine and Science in Sport and Exercise 1995).

Advantages
- Fast.
- Not difficult to operate

Disadvantages
- Error ratio +/-3 percent
- Results affected by h body temp of muscles
- Hydration levels can affect results
- Body hair can have an effect on the results
- Very expensive equipment
- Breathing pattern might affect the results

Duel Energy X-Ray Absorptiometry Body Fat Testing (DEXA)

DEXA uses two x-ray energies to measure body fat, body fat percentage, muscle and bone mineral. One must lie down on an x-ray table while the machine scans the body. It takes the machine about 10 to 15 minutes to produce the image of the tissue. Today, this method is considered a gold standard because of its reliability, precision, and the fact that it is based on three body components (fat, muscle, bone) rather than two (fat and muscle) as in most other methods (including hydrostatic weighing).

Advantages
- Under proper conditions, it provides accurate results
- Error Rate is less than 2% under proper conditions
- Radiation exposure is relatively low but it is still new technology

Disadvantages
- Very expensive equipment
- Costly
- Uses X-Rays (which raises the standard radiation concerns)
- Not easily accessible, or mobile
- Different DEXA equipment can produce different results
- X-Ray license required to use machine
- Frequent testing may be of concern due to radiation exposure.

Conclusion

• The accurate determination of individual's total body fat is an important issue because obesity is a significant contributing factor to variety of serious health problem. The medical literature identifies a wide range of diseases that are closely linked to obesity. These fat assessment methods are most appropriate which is important in defining disease risk.

• R J Maughan (1993) observed that measurement of body composition is an important part of any assessment of health or fitness. Hydrostatic weighing is generally accepted as the most reliable method for the measurement of body fat content, but is inconvenient. Electrical impedance analysers have recently been proposed as an alternative to the measurement of skinfold thickness.

• Rober R. Biaggi (1999) at all concluded in his study that air displacement is an accurate method for assessing body composition in healthy adults. Future studies should assess further the cause of the individual variations with this new method.

• Deanna K. Levanhagen (1999) compared air displacement plethysmography (ADP), with hydrostatic weighing (HW), bioelectrical impedance (BIA),dual-energy x-ray absorptiometry (DXA), and found that average percent body fat determined by ADP was similar to that by HW for the entire population, there was a significant gender difference with the average body fat measured by ADP being 16% less in males and 7% greater in females than that determined by HW. Conclusions: Body fat measurements using ADP were highly correlated with those using HW, BIA, and DXA across a relatively wide range of body fat levels in healthy adults.

• Dexa scans is most accurate technique but practicability limited because of expensive machine and expertise. After this hydrostatic weighing is most appropriate and generally use for the purpose of research. Skin fold measurement technique is accurate and widely used technique. If facilities of Dexa scan and hydrostatic weighing are unavailable.

• Assessment of fat play an importance role to determine whether an individual is underweight, normal or overweight. Which ultimately aim at determines health status of an individual and make aware whether he or she has to take serious consideration toward the body weight.

• These assessments allow working with diagnosis and improvement after the treatment and in planning out effective conditioning program according to the need and nature of sports.

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