

BODY COMPOSITION

The prevalence of overweight and obesity has increased sharply in recent years, and the trends are evident for children as well as adults. These trends have been associated with the low cost and availability of high-fat foods, as well as with declining levels of physical activity in the population. High levels of body fatness are associated with increased risk of coronary heart disease, stroke, and diabetes. While children are not generally at risk for heart disease or stroke, increases in blood pressure and cholesterol occur in overweight and obese children. In addition diabetes (type 2) has increasingly been diagnosed among children, even though this condition has generally been viewed as “adult-onset” diabetes. Obesity and heart disease risk factors are known to track through the life span, so it is important to document body composition as part of a comprehensive health-related fitness profile. Like other dimensions of health-related fitness, body composition does affect health status (even in childhood) and does improve with regular participation in physical activity.

A number of methods are available for estimating body composition, including underwater weighing, bioelectrical impedance, skinfold measures, and other anthropometry measures such as

body mass index (BMI) that are based on height and weight. Each approach has some limitations leading to overall measurement errors of 2% to 3% for estimates of percent body fat. Estimates based on height and weight such as BMI result in 5% to 6% error because body weight reflects muscle and bone mass and not just fat mass (Lohman, 1987, 1992). Skinfold estimates have lower prediction error and provide a more direct estimate of body fatness, and are the recommended approach in *FITNESSGRAM*. The skinfold procedure uses two sites that are easy to measure and whose measurement is not very invasive (triceps and calf). Because other techniques are available to directly estimate percent body fat, values from other devices can be directly entered as a calculated percent body fat in the *FITNESSGRAM* software.

Need Additional Information?

For additional information on the advantages and disadvantages of different body composition measures and justification for the *FITNESSGRAM* Healthy Fitness Zone criteria, visit the *FITNESSGRAM Reference Guide*. The *Guide* is available on the enclosed DVD or online at the *FITNESSGRAM* Web site, www.fitnessgram.net (go to the *Reference Guide* section). Read the chapter “Body Composition Assessments” by Lohman and Falls.



Skinfold Measurements

⇒ *Recommended*

This section provides information on measuring skinfolds, including suggestions on how best to learn to do skinfold measurements.

Test Objective

To measure the triceps and calf (and abdominal for college students) skinfold thicknesses for calculating percent body fat.

Equipment and Facilities

A skinfold caliper is necessary to perform this measurement. The cost of calipers ranges from \$5 to \$200. Both the expensive and inexpensive calipers have been shown to be effective for use by teachers who have had sufficient training and practice. Appendix A on page 81 lists a source for calipers.

Testing Procedures

The triceps and calf skinfolds have been chosen for *FITNESSGRAM* because they are easily measured and highly correlated with total body fatness. The caliper measures a double layer of subcutaneous fat and skin.

Measurement Locations

The triceps skinfold is measured on the back of the right arm over the triceps muscle, midway between the elbow and the acromion process of the scapula (photo 6.1). Using a piece of string to find the midpoint is a good suggestion. The skinfold site should be vertical. Pinching the fold slightly above the midpoint will ensure that the fold is measured right on the midpoint (photos 6.2 and 6.3).

The calf skinfold is measured on the inside of the right leg at the level of maximal calf girth. The right foot is placed flat on an elevated surface with the knee flexed at a 90° angle (photo 6.4). The vertical skinfold should be grasped just above the level of maximal girth (photo 6.5) and the measurement made below the grasp.

For college students, the formula for calculating percent body fat includes the abdominal skinfold measurement in addition to the triceps and calf skinfolds. The abdominal skinfold is measured at a site 3 centimeters to the side of the midpoint of

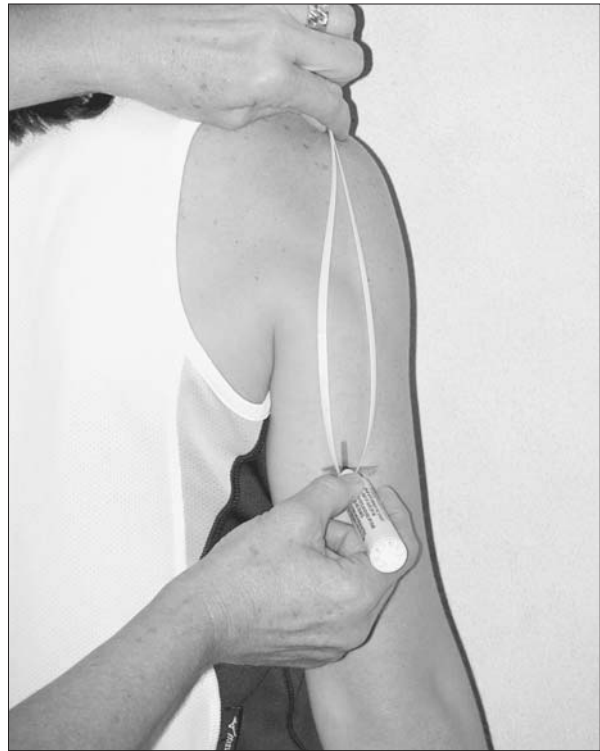


PHOTO 6.1 Locating the triceps skinfold site.



PHOTO 6.2 Site of the triceps skinfold.

(continued)

Skinfold Measurements (continued)



PHOTO 6.3 Triceps skinfold measurement.



PHOTO 6.4 Placement of the leg for locating the calf skinfold site.



PHOTO 6.5 Calf skinfold measurement.



PHOTO 6.6 Site of abdominal skinfold.



PHOTO 6.7 Abdominal skinfold measurement.

the umbilicus and 1 centimeter below it (photo 6.6). The skinfold is horizontal and should be measured on the right side of the body (photo 6.7) while the subject relaxes the abdominal wall as much as possible.

(continued)

Skinfold Measurements (continued)

Measurement Technique

- Measure skinfolds on the person's right side.
- Instruct the student to relax the arm or leg being measured.
- Firmly grasp the skinfold between the thumb and forefinger and lift it away from the other body tissue. The grasp should not be so firm as to be painful.
- Place the caliper 1/2 inch below the pinch site.
- Be sure the caliper is in the middle of the fold.
- The recommended procedure is to do one measurement at each site before doing the second measurement at each site and finally the third set of measurements.

Scoring

The skinfold measure is registered on the caliper. Each measurement should be taken three times, with the recorded score being the median (middle) value of the three scores. To illustrate: If the readings were 7.0, 9.0, and 8.0, the score would be recorded as 8.0 millimeters. Each reading should be recorded to the nearest .5 millimeters. For teachers not using the computer software, a percent fatness look-up chart is provided in appendix B on pages 96 and 97 and is also available on the enclosed DVD—access the PDFs titled “Girls Conversion Chart” and “Boys

Conversion Chart.” *FITNESSGRAM* uses the formula developed by Slaughter and Lohman to calculate percent body fat (Slaughter et al., 1988).

Suggestions for Test Administration

- Skinfolds should be measured in a setting that provides the child with privacy.
- Interpretation of the measurements may be given in a group setting as long as individual results are not identified.
- Whenever possible, it is recommended that the same tester administer the skinfold measurements to the same students at subsequent testing periods.
- Practice measuring the sites with another tester and compare results on the same students. As you become familiar with the methods you can generally find agreement within 10% between testers.

Learning to Do Skinfold Measurements

Using video training tapes or participating in a workshop are excellent ways to begin to learn how to do skinfold measurements. The videotape *Practical Body Composition Video* illustrates the procedures described in this manual. Appendix A contains information on obtaining this videotape.

**Body Mass Index**

⇒ *Alternative*

The BMI provides an indication of the appropriateness of a child's weight relative to height. Body mass index is determined by the following formula:

$$\text{weight (kg)} / \text{height}^2 \text{ (m)}$$

While the data can be entered in pounds and inches, the results are calculated with the metric formula. For example, a student weighing 100 pounds (45.36 kilograms) who is 5 feet (1.52 meters) tall would have a BMI of 19.6. Another student of the same weight but 5 feet 2 inches tall would have a BMI of 18.3.

Therefore, height and weight measures, recorded as a regular portion of the testing process for all students, are converted to metric units by the computer to calculate BMI—pounds to kilograms and

feet to meters. Recommended BMI scores are listed in chapter 9.

Have people remove their shoes when you are measuring height and weight. In measuring height and weight, you are encouraged to drop fractions of an inch or a pound and use the last whole number. For example, a height of 5 feet 5 1/2 inches would be recorded as 5 feet 5 inches, and a weight of 112.5 pounds would be recorded as 112 pounds.

A score that is classified as “Needs improvement” generally indicates that a child weighs too much for his or her height. Body mass index is not the recommended procedure for determining body composition because it does not estimate the percent of fat. It merely provides information on the appropriateness of the weight relative to the height. For children found to be too heavy for their height, a skinfold test would clarify whether the weight is due to excess fat.

Portable Bioelectric Impedance Analyzers

A number of portable bioelectric impedance analyzer (BIA) devices are now commercially available at a price that is reasonable for most physical education programs (<\$100). These devices estimate body composition by measuring the body's resistance to current flow. A body with more muscle will also have more total body water (and therefore have low resistance to current flow). A body with more fat will have less total body water and greater resistance to current flow. One type of device requires participants to stand on an instrument resembling

a bathroom scale while barefoot. Another type of device uses a handgrip system that has participants squeeze handles while extending the arms.

Preliminary results with these devices suggest that they provide similar classification accuracy and body composition estimates as skinfold calipers. Because these devices can produce estimates of body composition faster than a skinfold test and do not require specific skill or experience it may provide a useful alternative to skinfold testing in some schools. The procedure is also less invasive than skinfold testing and may be better accepted in some districts that have specific policies against the use of skinfold calipers.

