Name _____ Section _____ Date _____

Lab A6-3 *Alternative Skinfold Measurement Formulas to Calculate Percent Body Fat*

Lab 6-1 in your textbook contains a set of instructions for one method of using skinfold measurements to estimate percent body fat. This lab summarizes some of the many other different methods that have been developed for this purpose.

Skinfold Sites

Depending on your choice of method and formula, you will need measurements of three to seven of the following sites. (Refer to Chapter 6 in your text for instructions on skinfold measurement technique.)

Skinfold Site	Description	Measurement
Abdominal	Vertical fold; 2 cm. to the right side of umbilicus	_____
Triceps	Vertical fold; on the posterior midline of the upper arm, halfway between the acromion and olecranon processes, with the arm held freely to the side of the body	_____
Biceps	Vertical fold; on the anterior aspect of the arm over the belly of the biceps muscle, 1 cm above the level used to mark the triceps site	_____
Chest/Pectoral	Diagonal fold; one-half the distance between the anterior axillary line and the nipple (men) or one-third of the distance between the anterior axillary line and the nipple (women)	_____
Medial Calf	Vertical fold; at the maximum circumference of the calf on the midline of its medial border	_____
Midaxillary	Vertical fold; on the midaxillary line at the level of the xiphoid process of the sternum. (An alternate method is a horizontal fold taken at the level of the xiphoid/sternal border in the midaxillary line.)	_____
Subscapular	Diagonal fold (at a 45° angle); 1 to 2 cm below the inferior angle of the scapula	_____
Suprailiac	Diagonal fold; in line with the natural angle of the iliac crest taken in the anterior axillary line immediately superior to the iliac crest	_____
Thigh	Vertical fold; on the anterior midline of the thigh, midway between the proximal border of the patella and the inguinal crease (hip)	_____

Calculating Body Density from Skinfold Measurements

Choose a formula, plug in the sum of the appropriate skinfold measurements, and calculate body density or percent body fat. For methods that calculate body density, see below for instructions on converting body density to percent body fat.

MALES

Seven-Site Formula (Chest, Midaxillary, Triceps, Subscapular, Abdomen, Suprailiac, Thigh)

Body density = $1.112 - (0.00043499 \times \text{sum of seven skinfolds}) + (0.00000055 \times [\text{sum of seven skinfolds}]^2) - (0.00028826 \times \text{age})$

$= 1.112 - (0.00043499 \times \underset{\text{(skinfolds)}}{\_\_\_\_\_}) + (0.00000055 \times [\underset{\text{(skinfolds)}}{\_\_\_\_\_}]^2) - (0.00028826 \times \underset{\text{(age)}}{\_\_\_\_\_}) = \_\_\_\_\_$

(over)

LAB A6-3 *(continued)*

Four-Site Formula (Abdomen, Suprailiac, Triceps, Thigh)

% Body fat = (0.29288 × sum of four skinfolds) – (0.0005 × [sum of four skinfolds]^2) + (0.15845 × age) – 5.76377

= (0.29288 × _____ (skinfolds)) – (0.0005 × [_____ (skinfolds)]^2) + (0.15845 × _____ (age)) – 5.76377 = _____%

Three-Site Formulas

(Chest, Abdomen, Thigh)

Body density = 1.109380 – (0.0008267 × sum of three skinfolds) + (0.0000016 × [sum of three skinfolds]^2) – (0.000257 × age)

= 1.109380 – (0.0008267 × _____ (skinfolds)) + (0.0000016 × [_____ (skinfolds)]^2) – (0.000257 × _____ (age)) = _____

(Chest, Triceps, Subscapular)

Body density = 1.1125025 – (0.0013125 × sum of three skinfolds) + (0.0000055 × [sum of three skinfolds]^2) – (0.0002440 × age)

= 1.1125025 – (0.0013125 × _____ (skinfolds)) + (0.0000055 × [_____ (skinfolds)]^2) – (0.0002440 × _____ (age)) = _____

(Abdomen, Suprailiac, Triceps)

% Body fat = (0.39287 × sum of three skinfolds) – (0.00105 × [sum of three skinfolds]^2) + (0.15772 × age) – 5.18845

= (0.39287 × _____ (skinfolds)) – (0.00105 × [_____ (skinfolds)]^2) + (0.15772 × _____ (age)) – 5.18845

= _____%

Two-Site Formula

(Thigh, Subscapular)

[Note: This formula was based on a sample of young adults and will be less accurate when used with older individuals.]

Body density = 1.1043 – (0.001327 × thigh skinfold) – (0.00131 × subscapular skinfold)

= 1.1043 – (0.001327 × _____ (thigh)) – (0.00131 × _____ (subscapular))

= _____

FEMALES

Seven-Site Formula (Chest, Midaxillary, Triceps, Subscapular, Abdomen, Suprailiac, Thigh)

Body density = 1.0970 – (0.00046971 × sum of seven skinfolds) + (0.00000056 × [sum of seven skinfolds]^2) – (0.00012828 × age)

= 1.0970 – (0.00046971 × _____ (skinfolds)) + (0.00000056 × [_____ (skinfolds)]^2) – (0.00012828 × _____ (age)) = _____

Four-Site Formula (Abdomen, Suprailiac, Triceps, Thigh)

% Body fat = (0.29669 × sum of four skinfolds) – (0.00043 × [sum of four skinfolds]^2) + (0.02963 × age) + 1.4072

= (0.29669 × _____ (skinfolds)) – (0.00043 × [_____ (skinfolds)]^2) + (0.02963 × _____ (age)) + 1.4072 = _____%

Three-Site Formulas

(Triceps, Suprailiac, Thigh)

Body density = 1.0994921 – (0.0009929 × sum of three skinfolds) + (0.0000023 × [sum of three skinfolds]^2) – (0.0001392 × age)

= 1.0994921 – (0.0009929 × _____ (skinfolds)) + (0.0000023 × [_____ (skinfolds)]^2) – (0.0001392 × _____ (age)) = _____

(over)

(Abdomen, Suprailiac, Triceps)

% Body fat = (0.41563 × sum of three skinfolds) – (0.00112 × [sum of three skinfolds]^2) + (0.03661 × age) + 4.03653

= (0.41563 × _____ (skinfolds)) – (0.00112 × [_____ (skinfolds)]^2) + (0.03661 × _____ (age)) + 4.03653

= _____%

Two-Site Formula
(Suprailiac, Triceps)

[Note: This formula was based on a sample of young adults and will be less accurate when used with older individuals.]

Body density = 1.0764 – (0.0008 × suprailiac skinfold) – (0.00088 × triceps skinfold)

= 1.0764 – (0.0008 × _____ (suprailiac)) – (0.00088 × _____ (triceps))

= _____

Calculating Percent Body Fat from Body Density

If the skinfold formula you selected calculated a value for body density rather than percent body fat, you'll need to plug that value into the appropriate formula from the table below in order to calculate percent body fat. (*Note:* Population-specific formulas don't exist for all ethnic or age groups; use the formula for whites of the appropriate age and gender if there is no population-specific formula appropriate for you.)

Body density (from formula above): _____

Percent body fat = (_____ (factor from table) ÷ _____ (body density)) – _____ (factor from table) = _____%

Population-Specific Formulas for Conversion of Body Density to Percent Body Fat

Population	Age	Gender	Percent Body Fat
Ethnicity			
White	8–12	Male	(5.27 ÷ BD) – 4.85
		Female	(5.27 ÷ BD) – 4.85
	13–17	Male	(5.12 ÷ BD) – 4.69
		Female	(5.19 ÷ BD) – 4.76
	18–59	Male	(4.95 ÷ BD) – 4.50
		Female	(4.96 ÷ BD) – 4.51
	60–90	Male	(4.97 ÷ BD) – 4.52
		Female	(5.02 ÷ BD) – 4.57
Black	19–45	Male	(4.86 ÷ BD) – 4.39
	24–79	Female	(4.86 ÷ BD) – 4.39
Hispanic	20–40	Female	(4.87 ÷ BD) – 4.41
American Indian	18–62	Male	(4.97 ÷ BD) – 4.52
	18–60	Female	(4.81 ÷ BD) – 4.34
Japanese Native	18–48	Male	(4.97 ÷ BD) – 4.52
		Female	(4.76 ÷ BD) – 4.28
	61–78	Male	(4.87 ÷ BD) – 4.41
		Female	(4.95 ÷ BD) – 4.50
Levels of body fatness			
Anorexic	15–44	Female	(4.96 ÷ BD) – 4.51
Obese	17–62	Female	(4.95 ÷ BD) – 4.50

Source: Adapted by permission from V. Heyward, and D. Wagner. 2004. *Applied Body Composition Assessment, 2nd ed.* Champaign, IL.: Human Kinetics. Used with permission from the publisher

Sources: Jackson, A. S., and M. L. Pollock. 1985. Practical assessment of body composition. *Physician and Sportsmedicine* 13:76–90. Reprinted with permission from The McGraw-Hill Companies. American College of Sports Medicine. 2000. *ACSM's Guidelines for Exercise Testing and Prescription,* 6th ed. Baltimore: Lippincott Williams & Wilkins. Used with permission from the publisher. Sloan, A. W. 1962. Estimating body fat in young women. *Journal of Applied Physiology* 17: 967–970. Sloan, A. W. 1967. Estimation of body fat in young men. *Journal of Applied Physiology* 23: 311–315.