

1

Energy Balance and Body Composition

In this chapter you will learn about:

- ◆ Energy balance.
- ◆ Estimating energy needs.
- ◆ Body composition and body fat distribution.

Maintaining a healthy body weight and body fat percentage through sound dietary and exercise practices helps to ensure optimal health, fitness, and physical performance. All of these issues are relevant in maintaining military readiness and force health protection, and in promoting optimal health of military personnel. This chapter introduces you to the basic concepts of energy balance and body composition.

Energy Balance

Energy balance is the difference between the number of kilocalories (kcal or Calories) you eat (intake) and the number of kcal you burn (output).

Figure 1-1. Energy Balance: Intake vs. Output

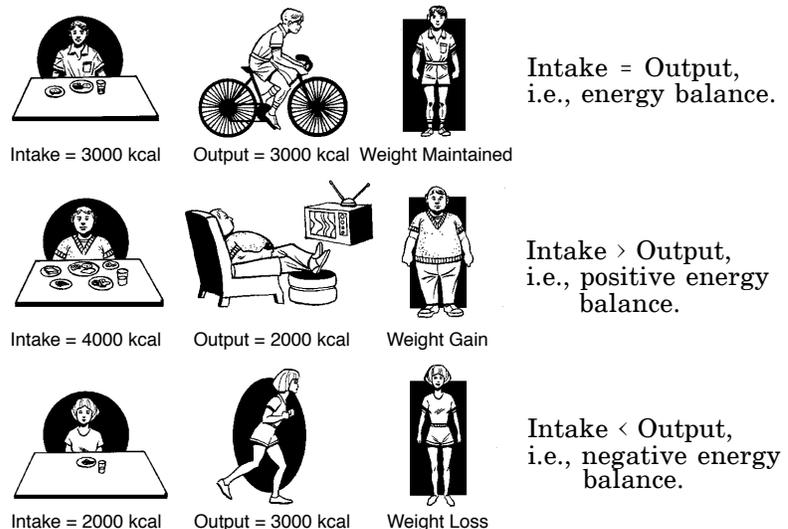


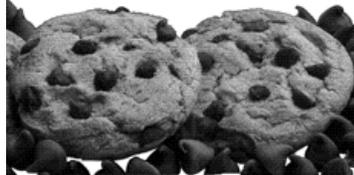
Figure taken from FI Katch and WD McArdle. *Nutrition, Weight Control, and Exercise*, 3rd Ed. Philadelphia: Lea & Febiger, 1988.

Sensitivity of Energy Balance

Energy balance can be changed by altering energy intake, energy output, or both, as shown in the following examples. (1 pound (lbs.) of fat equals 3,500 kcal.)

Example 1:

Eating 1 extra chocolate chip cookie (65 kcal) each day for 1 year would be: $65 \text{ kcal} \times 365 = 23,725 \text{ kcal}$. This would add up at the end of the year to a total net weight gain of 6.8 lbs. ($23,725 \div 3,500$).

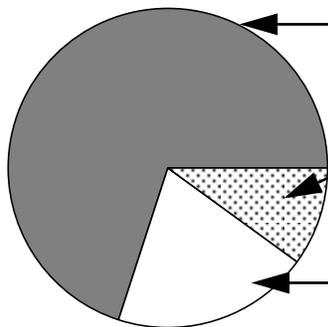


Example 2:

If you maintain your kcal intake and run an extra mile per day, 5 days per week, you would expend an extra $100 \text{ kcal/mile} \times 5 \text{ miles/week} \times 52 \text{ weeks} = 26,000 \text{ kcals}$ per year. This would result in a net weight loss of 7.4 lbs. per year ($26,000 \div 3,500$).

Estimating Energy Needs

Energy needs are based on daily energy output or expenditures. The three major contributors to energy expenditure are:



Basal Metabolic Rate (BMR): This is the energy needed to maintain life. Calculate your BMR using [Worksheet 1-1](#).

Digestion: A small amount of energy is needed to digest food. This is accounted for in the BMR equation in [Worksheet 1-1](#).

Physical Activity: Energy is needed during physical activity. Estimate your activity factor from [Table 1-1](#).

Worksheet 1-1. Calculate Your BMR

Equation for:	Age (years):	Equation:
Men:	18-30	$6.95 \times \text{body weight (lbs.)} + 679$
	30-60	$5.27 \times \text{body weight (lbs.)} + 879$
Women:	18-30	$6.68 \times \text{body weight (lbs.)} + 496$
	30-60	$3.95 \times \text{body weight (lbs.)} + 829$

Your BMR is _____ kcal/day.

Table 1-1. Estimate Your Activity Factor

	Level of Activity	Activity Factor
Very Light	Seated and standing activities, driving, playing cards, computer work.	1.2
Light	Walking, sailing, bowling, light stretching, golf, woodworking, playing pool.	1.4
Moderate	Jogging, aerobic dance, light swimming, biking, calisthenics, carrying a load.	1.6
Strenuous	Stairmaster, ski machine, racquet sports, running, soccer, basketball, obstacle course, digging, carrying a load uphill, rowing.	1.9
Exceptional	Running or swimming races, cycling uphill, hard rowing, carrying heavy loads.	2.3

Your Activity Factor is _____.

Total Daily Estimated Energy Requirement

Your total daily estimated energy requirement (EER) is the amount of kcals you need to eat each day to offset the energy expended through your BMR and physical activity and maintain an energy balance of zero. Calculate your EER in [Worksheet 1-2](#).

Worksheet 1-2. Calculate Your Estimated Energy Requirement (EER)

$$\text{Energy Needs} = \frac{\text{_____}}{\text{*BMR}} \times \frac{\text{_____}}{\text{*Activity Factor}}$$

Your Estimated Energy Requirement (EER) = _____ kcal/day.

*Your BMR is calculated in [Worksheet 1-1](#). The Activity Factor is from [Table 1-1](#). The estimated energy needs of typical 19-50 year old men and women who are light to moderately physically active are 2,900 and 2,200 kcals/day, respectively.

By meeting your EER, you should have an energy balance of “zero” and maintain your current body weight. If your goal is to either lose or gain weight, adjust your kcal intake only slightly and engage in a well-rounded exercise program. A healthy goal when losing or gaining weight is to lose or gain 1/2 - 1 lbs. per week.

For specific questions about weight management and kcal requirements, consult the **Navy Nutrition and Weight Control Self-Study Guide** (NAVPERS 15602A at <http://www-nehc.med.navy.mil> and <http://www.bupers.navy.mil/services> under “Navy Nutrition and Weight Control), or talk to a Registered Dietitian, your Command Fitness Coordinator, or your doctor. Also, see [Chapter 3](#) to learn about eating healthfully.



Body Composition

The Body Mass Index (BMI) can be easily calculated to assess your body composition. Calculate your BMI in [Worksheet 1-3](#) and compare it to the classifications.

Worksheet 1-3. Calculate Your BMI



$$\text{Your BMI} = \frac{\text{body weight (lbs)}}{\text{height (inches)}^2} \times 705 = \text{ratio}$$

Ratio:	Classification:
<20	Underweight
20-25	Normal
25-30	Overweight
>30	Obese

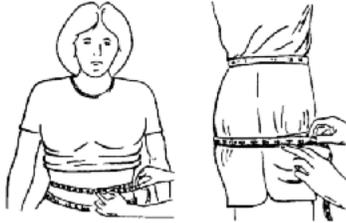
The BMI classifications have been developed to identify individuals at risk for being either over- or underweight. However, BMI can misclassify some large frame or muscular people as overweight. It is strictly a ratio and does not necessarily reflect percent body fat accurately. If you feel your BMI incorrectly categorizes you, have your percent body fat measured by a trained professional. Body fat can be determined from a variety of techniques including hydrostatic (underwater) weighing, skinfold measurements, and circumference measurements (as done in the Navy).

Fat Distribution

In addition to BMI, it is helpful to know your waist-to-hip ratio (WHR). This ratio determines your pattern of fat distribution, i.e., where you store body fat. The formula for calculating waist-to-hip ratio is:

Worksheet 1-4. Calculate Your Waist-to-Hip Ratio

$$\text{Your WHR} = \frac{\text{waist circumference (inches)}}{\text{hip circumference (inches)}} = \text{ratio}$$



Standards for Waist-to-Hip Ratios

Men: <0.95

Women: <0.80

Ratios greater than those listed above indicate a tendency toward central (torso) obesity. People who store excess fat in their mid-sections are at increased risk for heart disease and diabetes.

In the following chapters you will learn sound nutritional practices and ways to enhance your physical performance. Importantly, you will see how good nutrition and a balanced exercise program together influence your physical fitness, military readiness, and ultimately your overall health.