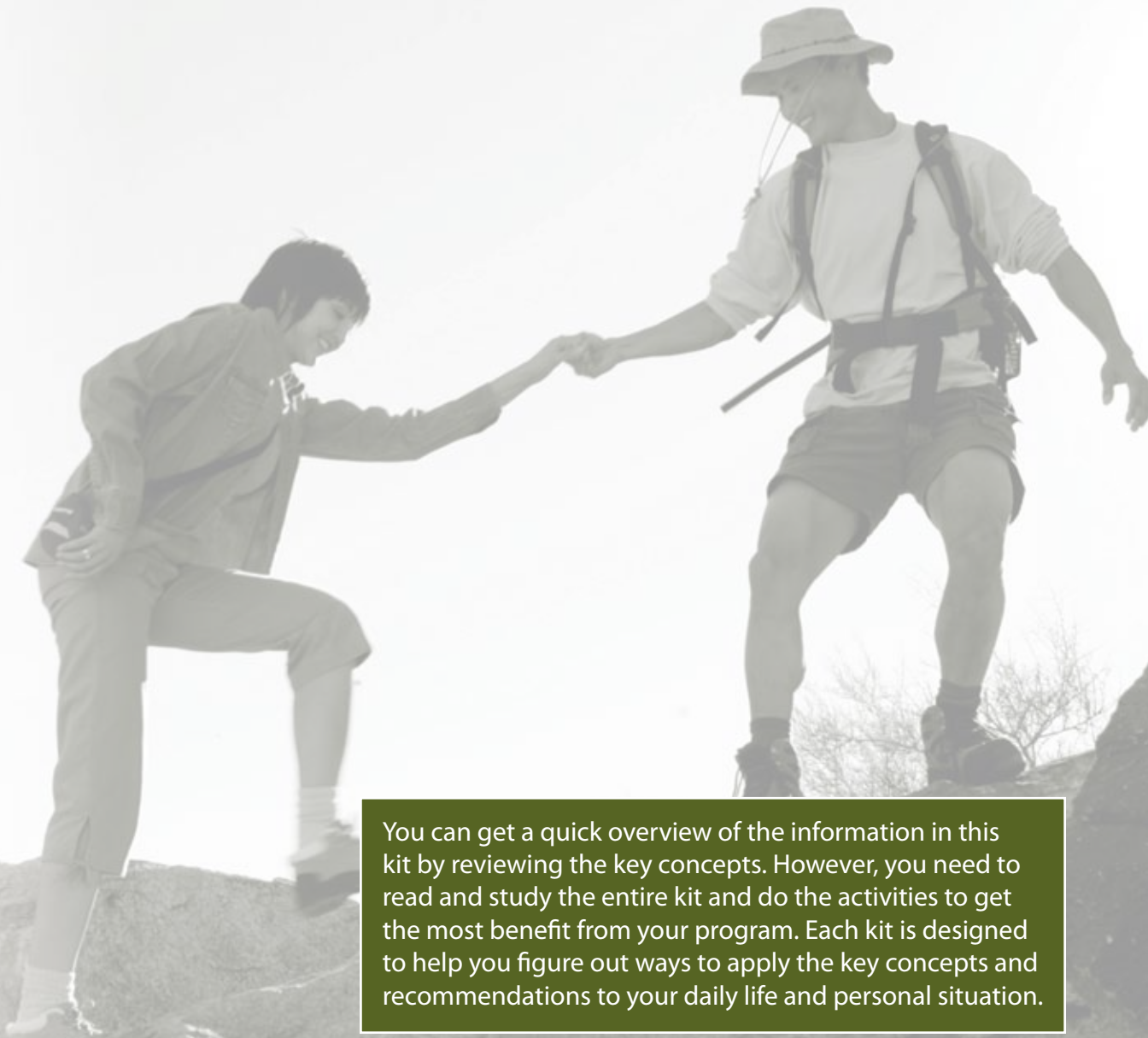


Balancing Energy



You can get a quick overview of the information in this kit by reviewing the key concepts. However, you need to read and study the entire kit and do the activities to get the most benefit from your program. Each kit is designed to help you figure out ways to apply the key concepts and recommendations to your daily life and personal situation.

Key Concepts

- When “calories in” equals “calories out,” a state of energy balance is achieved and body weight remains constant.
- When “calories in” is less than “calories out,” a state of negative energy balance occurs and body weight decreases.
- When “calories in” is greater than “calories out,” a state of positive energy balance occurs and body weight increases.
- Overweight is a complex condition with multiple, interrelated causes including genetic, cultural, environmental and hormonal factors.
- Food provides energy (calories or kilojoules) for the body in the form of carbohydrates, protein, alcohol and fat. Each source is unique in the way it is used and stored in the body.
- The body uses (or burns) calories or kilojoules in three ways: thermic effect of food – digesting, absorbing, transporting and storing food (about 10 percent of “calories out”), physical activity – all voluntary movement of muscles (20 to 30 percent of “calories out”) and resting metabolism to sustain life – breathing, thinking, etc. (typically 60 to 70 percent of “calories out”).
- Resting metabolism is affected by many factors, including body composition, age, gender, height, growth, activity level, fever, stress, environmental temperature, fasting, malnutrition, thyroid hormone and weight cycling.
- An individual’s total “calories in” and “calories out” can be estimated or measured. These values are considered when recommending the meal plan and target fat gram goal.
- A deficit of 3,500 calories (or 14,654 kilojoules) is required to lose one pound (.45 kg) of fat (decrease “calories in,” increase “calories out” or do both).
- There is no “quick fix” for weight loss or weight management.

Getting There



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Know the Energy Balance Equation

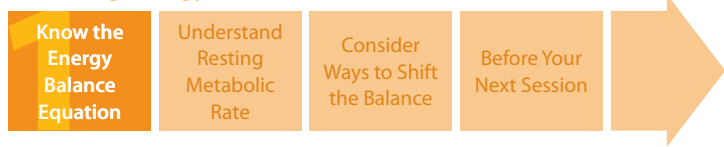
“Calories In”

Food provides calories (energy) for the body in the form of carbohydrate, protein, alcohol and fat. Any calories from food that are not used immediately for energy production are stored. Each source of calories is unique in the way it is used and stored by the body.

REFERENCE



Sources of Calories	
Carbohydrate	Carbohydrates are usually the main source of energy for the body. Our meal plans typically recommend that approximately 45 to 65 percent of total daily calories come from complex carbohydrates. Carbohydrate contains four calories per gram (about 17 kilojoules per gram) and is stored in the body (in limited amounts) as glycogen.
Protein	The body uses protein to build and maintain body tissue and to regulate body processes. Our meal plans typically recommend that approximately 10 to 20 percent of total daily calories come from protein. Protein contains approximately four calories (17 kilojoules) per gram, but the body rarely uses it for energy. Like carbohydrate, the body can only store limited amounts of protein.
Alcohol	Although not a major source of energy for the body, alcohol contains seven calories per gram (about 29 kJ per gram). The body uses alcohol as fuel immediately and does not store it in the body. Alcohol may contribute to fat storage by causing the body to store fat rather than use it as fuel.
Fat	Fat is the most calorie-dense of the nutrients and contains nine calories per gram (about 38 kJ per gram). Our meal plans typically recommend that approximately 20 to 35 percent of total daily calories come from fat. The body is more efficient at storing fat than it is at storing carbohydrate and protein. The body has an almost unlimited capacity to store fat.



“Calories Out”

Counting the calories provided by the food you eat tells you your “calories in,” but to balance your energy you also need to know your “calories out.” The body uses (or burns) calories in three ways:

REFERENCE



Burning Calories	
Thermic Effect of Food	The body uses calories to digest, absorb, transport and store food. This process, called the thermic effect of food, typically represents only about 10 percent of the “calories out.” The type of food you eat strongly influences the precise number of calories used. The thermic effect is higher for protein and carbohydrates than for fat. This is one reason why it is easier to gain weight from excess fat calories than from excess carbohydrate calories. Eating a low-fat diet is important for weight loss and weight management.
Physical Activity	The body uses calories for physical activity, including exercise and all other activity that uses muscles for movement, even fidgeting. Because most physical activity is voluntary, it is the most variable part of “calories out” in the energy equation. The number of calories burned varies from individual to individual and day to day. Calories for physical activity may represent less than 20 percent of “calories out” for a sedentary person or more than 30 percent for someone very physically active. Calories for physical activity depend upon the type of activity, intensity (how hard you exert yourself) and duration (minutes) of the exercise.
Resting Metabolism	The body uses calories to sustain life. Resting metabolism provides the energy the body needs to pump blood, inhale and exhale, maintain body temperature, send and receive nerve impulses, think and make important chemicals in the cells. Resting metabolism occurs in a continual process throughout 24 hours a day and remains relatively constant over time. Resting metabolism is the largest component (typically 60 to 70 percent) of “calories out” in the energy equation.

The Energy Balance Equation

Most people maintain a steady energy balance over time. You may eat a little more or less on any given day or do a little more or less physical activity. Your weight may go up or down by a pound or two. But for the most part, you maintain a balance. When the balance shifts, your weight changes.

REFERENCE



Energy Balance and Weight Changes

“Calories In”	Maintaining Energy Balance	“Calories Out”
<ul style="list-style-type: none"> • Carbohydrate = 4 calories/gram (17 kJ/gram) • Protein = 4 calories/gram (17 kJ/gram) • Alcohol = 7 calories/gram (29 kJ/gram) • Fat = 9 calories/gram (38 kJ/gram) 	<p>“Calories In” Equal To “Calories Out”</p> <p>Weight Does Not Change</p>	<ul style="list-style-type: none"> • Thermic Effect of Food (10% of “calories out”) • Physical Activity (20 to 30% of calories out”) • Resting Metabolism (60 to 70% of “calories out”)
	<p>“Calories In” Less Than “Calories Out”</p> <p>Lose Weight</p>	
	<p>“Calories In” Greater Than “Calories Out”</p> <p>Gain Weight</p>	

2

Understand Resting Metabolic Rate

The rate at which the body uses calories for life-sustaining processes is called resting metabolic rate (RMR). RMR is usually given as calories per day. The table below shows the effect various factors tend to have on RMR.

REFERENCE



Resting Metabolic Rate	
Factor	Effect on RMR
Body composition (proportion of lean to fat tissue in the body)	Resting metabolic rate depends primarily on body composition. Muscle tissue is active and fat tissue is inactive. The more lean (muscle) tissue, the higher the RMR. The more fat tissue, the lower the RMR.
Age	RMR is higher in youth and decreases with age, mainly due to changes in lean muscle tissue.
Gender	Men have higher RMRs than women primarily because they have more muscle tissue.
Height	Tall people have more surface area on their bodies and have higher RMRs.
Growth	Children and pregnant women have higher RMRs.
Activity level	Active people have higher RMRs.
Fever	Fever raises RMR.
Stress	Stress raises RMR.
Environmental temperature	Both heat and cold raise RMR.
Fasting/starvation	Fasting/starvation lowers RMR by 15 to 30 percent to conserve energy. The decline in RMR starts after several days of "dieting."
Malnutrition (not eating essential nutrients for good health)	Malnutrition lowers RMR.
Thyroxin (thyroid hormone)	Thyroxin is a key RMR regulator. The more thyroxin produced, the higher the RMR.
Losing and regaining weight (weight cycling)	Typically, RMR decreases with weight loss. However, weight cycling does not seem to permanently affect RMR.

Know the
Energy
Balance
Equation

**Understand
Resting
Metabolic
Rate**

Consider
Ways to Shift
the Balance

Before Your
Next Session



Estimating Total Daily “Calories In” and “Calories Out” for Weight Management

We can estimate the total number of calories a person burns each day using a two-step process:

1. Estimate calories for RMR using a variety of different formulas that consider factors such as age, gender, height and body weight.
2. Determine the total daily “calories out” by multiplying the RMR by a physical activity factor based on how physically active the person is throughout the day.

Because the thermic effect of food is relatively small and constant for most people, it is included in the physical activity factor.

REFERENCE



Example

1. The estimated RMR for a 45-year-old woman who weighs 157 pounds is calculated to be 1,592 calories per day.
2. Because she does little physical activity during work or recreation (she is very sedentary) her physical activity factor is 1.3. Her daily “calories out” is $1,592 \times 1.3 = 2,070$.

Energy Balance: To maintain her current weight, her daily “calories in” should be 2,070. (“Calories in” must equal “calories out” to maintain current weight.)

Estimated vs. Actual RMR

The example above included two estimates: RMR and physical activity. Estimates always contain potential for error. Even small errors in total daily calorie needs can make a big difference over time and can hinder a person’s efforts to maintain or lose weight. Consider the difference between the estimated and the actual measured RMR for the woman in the example above.

Estimated RMR = 1,592 calories per day

Estimated total daily calories for weight maintenance = 2,070

Actual RMR = 1,426 calories per day (10.4% less than estimated RMR)

Actual total daily calories for weight maintenance = 1,854 ($1,426 \times 1.3$)

If the woman ate the 2,070 calories per day that were recommended (based on an estimated RMR) to maintain her body weight, she would actually gain weight. The extra 216 calories per day ($2,070 - 1,854 = 216$) would cause her to gain one pound every 16 days ($216 \times 16 = 3,456$; 3,500 calories = one pound of body weight) rather than maintain her weight.

Resting Metabolic Rate and Genetic Factors

Scientific studies have shown that resting metabolic rate, the major component of “calories out,” is determined by genetics or family traits, as well as many other factors. Ethnicity is a genetic trait. Studies have shown that several ethnic minority populations, such as Native Americans, Mexican Americans and African Americans, are especially prone to overweight. The RMRs of African American women have been shown to be lower than the RMRs of Caucasian women. Further research is needed to determine if the lower RMRs in African American women contribute to a higher incidence of overweight. Formulas for estimating RMR cannot possibly take into account the influence of genetics and certain other factors. Therefore, the common practice of estimating RMR is likely to be even more prone to error for certain populations, such as African American women.

Measuring Actual Resting Metabolic Rate

The way the body burns calories from food to produce energy is similar to the way a wood-burning stove works. The stove gradually burns pieces of wood in the presence of oxygen, producing carbon dioxide, water vapor and heat. The body gradually burns calories from food in the presence of oxygen, again producing carbon dioxide, water vapor and heat. This process is called oxidation.

Because oxidation in the body is well understood, the amount of total heat or energy the body produces at rest (the body's resting metabolic rate) can be measured.

We measure RMR by a process called indirect calorimetry using a device called a metabolic cart. The device measures energy produced by the body at rest by monitoring the amounts of oxygen consumed and carbon dioxide produced (exhaled). Until recently, metabolic carts were expensive and somewhat cumbersome to use. New, relatively inexpensive equipment is now available to measure resting metabolic rate.

See the information sheet "Measuring Resting Metabolic Rate (RMR)" at the end of this kit for additional details.

Resting Metabolic Rate and Weight Management

Studies suggest that people with lower than expected RMRs are more likely to gain weight over a period of time than those with higher RMRs. People with lower RMRs have "thrifty metabolisms" that conserve calories and promote overweight. They also seem more likely to experience greater difficulty losing weight and may have to restrict their daily "calories in" more to lose a given amount of weight.

REFERENCE



Do You Have a Thrifty Metabolism?

If your RMR is:		
Within the Expected Range	Higher than Expected	Lower than Expected
You are at an average risk for gaining weight in the future.	You may be at a lower risk for gaining weight in the future than someone with a lower RMR.	You may be at a greater risk for gaining weight in the future than someone with a higher RMR.
Reaching and/or maintaining a healthy weight should not be especially difficult for you.	You may experience less than expected difficulty in reaching and/or maintaining a healthy weight.	You may experience greater than expected difficulty in reaching and/or maintaining a healthy weight.

We can use your measured RMR to calculate your total daily calorie needs and recommend your meal plan and target fat gram goal. Even if your RMR is lower than expected, knowing your value increases the likelihood you will be successful in your attempt to manage your weight.

Re-measuring RMR

Consider re-measuring your RMR when you have reached your long-term weight goal to determine the total number of calories you should eat each day to maintain your weight. You should also consider having your RMR re-measured if you are:

- Attempting to lose weight, have not yet reached your goal and have reached a plateau in weight loss
- Having difficulty maintaining your weight goal



Respiratory Quotient

If you have an RMR test to measure your actual resting metabolic rate, it may also be possible to calculate your respiratory quotient (RQ). The respiratory quotient is the ratio of carbon dioxide produced to oxygen consumed. It is an index of the proportion of fat and carbohydrate burned for energy production.

At rest, you burn a combination of carbohydrate and fat for energy. The body rarely uses protein for energy except in severe cases of starvation. In the fasting state, a normal RQ is approximately 0.83. RQ values closer to 0.7 indicate “fat burning,” while values closer to 1.0 indicate “carbohydrate burning.”

Implications of RQ for Weight Management

Higher fasting RQs have been linked to a tendency toward overweight regardless of RMR. Some studies suggest that people who are “carbohydrate burners” tend to conserve fat and over time gain weight faster than “fat burners.” In one weight loss study, people were more likely to lose weight if they had a low RQ. Irrespective of your RQ, your personal meal plan and target fat gram and carb goals will help you achieve your weight goal.

If you drink alcohol, you may want to consider reducing or eliminating it. The body uses alcohol immediately as fuel rather than storing it. Because the body burns alcohol in preference to fat, any fat eaten with alcohol is more likely to be stored. Drinking alcohol with a high-fat meal has been called “drinking butter.” Many people who drink alcohol have been able to lose significant amounts of weight by eliminating alcohol from their diet.

3

Consider Ways to Shift the Balance

To lose one pound, you must create a deficit of 3,500 calories. To gain one pound, you must have an excess of 3,500 calories. On the average, a deficit or excess of 500 calories a day brings about a weight loss or gain, respectively, of one pound a week. A deficit or excess of 1,000 calories a day brings about a change of two pounds per week.

Very active people and very overweight people may lose weight faster than others, but for most people the recommended rate of weight loss is one to two pounds per week (about 0.5 to 1 kg per week). Meal plans for weight loss typically provide 1,000 to 1,500 “calories in” a day (4,180 to 6,270 kilojoules). Eating less than 1,000 calories a day causes most people to lose lean muscle tissue and makes it difficult to get all the vitamins and minerals needed for good health.

TIPS



Increasing “Calories Out”	
Tip	Details
Exercise regularly	<ul style="list-style-type: none"> Exercise increases “calories out.” Aerobic exercise, which uses large muscle groups, is the best way to burn calories. Examples include walking, jogging, cycling, swimming, rowing and dancing. Initially, sedentary individuals should try to gradually build up to 30 to 45 minutes of moderate intensity exercise on three to five days per week.
Increase exercise frequency, intensity and time (F.I.T.)	<ul style="list-style-type: none"> Over time, physical activity should increase to at least 30 to 60 minutes every day or nearly every day of the week. A goal of burning about 2,000 calories per week (about 8,360 kilojoule per week) is recommended. See the kit “Using the Nationwide Better Health Points System” for more information. You actually burn more calories during and after exercise – for about 30 minutes to 24 hours after a workout, your RMR is faster than normal. Your RMR tends to stay elevated longer with higher intensity exercise. You can make the most of this “afterburn” by increasing your exercise duration (amount of time) and intensity (how hard you exercise).
Consider low-intensity exercise	<ul style="list-style-type: none"> Both high- and low-intensity exercise offer advantages and disadvantages for weight management. The major advantages of lower intensity exercise are: <ul style="list-style-type: none"> You may enjoy it more and be more likely to do it You are less likely to get injured You actually burn a higher proportion of fat for energy You can exercise longer, which also allows you to burn a higher proportion of fat for energy
Try strength training	<ul style="list-style-type: none"> Although further research is needed, studies suggest the decline in RMR that typically occurs with weight loss can be partly offset by exercise training, which preserves muscle. When exercise training is the reason for “calories out” being greater than “calories in,” RMR remains unchanged during weight loss. This result occurs whether the exercise is aerobic or strength training. Also, strength training helps you maintain or increase your muscle tissue and increase your RMR.



TIPS



Increasing “Calories Out” (continued)	
Tip	Details
Add lifestyle physical activity	<ul style="list-style-type: none"> • Look for opportunities to include lifestyle physical activity, such as taking the stairs or doing household chores, in your daily routine. • See the kit “Adding Physical Activity to Your Lifestyle” for ways to reduce sedentary time by engaging in frequent, less strenuous activities.
Eat smaller meals more often	<ul style="list-style-type: none"> • Because your RMR speeds up after each meal (due to the thermic effect of food), you may benefit from eating five or six smaller meals spread throughout the day rather than three meals a day.
Eat less fat	<ul style="list-style-type: none"> • Your body processes and stores fat very efficiently and prefers to store it rather than burn it immediately for energy. • Your body usually either burns carbohydrates quickly or stores them as glycogen. • The thermic effect of food is higher after a high-carbohydrate meal than after a high-fat meal, which means your RMR speeds up more after a high-carbohydrate meal.

ACTIVITY



My Plan to Shift Energy Balance

If you need to lose weight, list three things you will do to start shifting toward negative energy balance.

1. _____
2. _____
3. _____

Nationwide Better Health Can Help

All people who are overweight need help in modifying their meal plans and eating habits, increasing their physical activity and managing their stress. As a behavior modification and lifestyle management program, Nationwide Better Health addresses all three of these critical components in an integrated approach. Even if your RMR is slow or you are a “carbohydrate burner,” we can help with an individualized plan developed especially for you. Our recommendations are based on the best and most up-to-date scientific information available, and you can trust that our program is safe and effective.

Remember, there is no “quick fix” for weight management. For adults, the difficulty of losing a significant amount of weight and keeping it off long term is similar to the difficulty of learning a foreign language. It is a goal that can be achieved by anyone who has competent guidance and is prepared to invest sufficient effort, but it always takes a lot of work.

REFERENCE



Measuring Resting Metabolic Rate (RMR)

If you are interested in having your RMR measured, the procedure is very simple. The test is typically done early in the morning and requires approximately one hour.

Before the Test

- You will be given specific instructions for how to prepare for the test.
 - Dress comfortably in loose fitting clothing.
 - Fast overnight. Don't eat or drink (except water) for at least 12 hours.
 - Don't engage in any strenuous exercise the day before the test (don't work out for more than 60 minutes) and avoid physical activity as much as possible on the morning of the test (don't work out at all).
 - If you take insulin, do not take your morning dose until after your test. Take all other medications as usual. Bring all your medications with you to the test.
- You will be asked to read and sign an Informed Consent that explains the purpose, benefits and risks associated with the test.
- The fitness professional administering the test will explain the test procedures to you in detail and you may ask questions.
- The fitness professional will measure your height, weight and waist circumference.
- You will place the breathing mask over your nose and mouth and breathe normally for a few minutes to become familiar with the process.

During the Test

- The test is conducted in a quiet, dimly lighted room. You will lie down or recline in a comfortable position for about 30 minutes.
- You will wear the breathing mask and breathe normally. The air you breathe will be the air present in the room you are in. Tubes from the facemask are connected to special equipment, which will analyze the air that is exhaled.
- Try to relax as much as possible, but don't fall asleep. Lie still and don't fidget or look around. Don't sit up and don't talk unless you are experiencing problems.

After the Test

- You will remove the mask.
- You may be provided with a written report.
- You should plan to have a snack or breakfast after the test.

Know the
Energy
Balance
Equation

Understand
Resting
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Consider
Ways to Shift
the Balance

Before Your
Next Session

4

Before Your Next Session

In the time between your sessions with your health coach, do the following:

- Be sure to read and complete this educational kit.
- Use this kit to record your work.
- Have this kit with you for your next session.

REVIEW



Check Yourself

Complete the statements to be sure you understand the key concepts in this kit.

1. Energy must be either used or _____.
2. Overweight and obesity are the end results of a _____ between “calories in” and “calories out.”
3. _____ is usually the main source of energy for the body.
4. Protein is _____ used by the body for energy.
5. Body _____ is the preferred way to store energy.
6. Typically, about _____ percent of the calories eaten are burned in the processing of a meal by the body.
7. It is easier to gain weight from excess calories from _____ than from excess calories from carbohydrates.
8. _____ is the largest component of “calories out” in the energy equation.
9. Muscle tissue is _____ and fat tissue is _____.
10. Active people tend to have a _____ RMR.
11. Fasting/starvation lowers the RMR by 15 to 30 percent to _____ energy.
12. People with a lower than expected RMR are more likely to _____ weight over a period of time than those with a higher RMR.
13. For about 30 minutes to 24 hours after a workout, your resting metabolic rate is _____ than normal.

Answers: 1) stored; 2) mismatch; 3) Carbohydrate; 4) rarely; 5) fat; 6) 10; 7) fat; 8) Resting metabolic rate; 9) active; 10) higher; 11) conserve; 12) gain; 13) faster

Write any questions for your health coach here.