

Lesson 3: Energy Balance

Introduction

As discussed in Module C, Lesson 2, energy expenditure is half of the energy balance equation. To maintain a steady body weight, the energy spent should approximately equal the energy consumed. Daily variations occur, but over time calories out and calories in should be approximately equal.

Energy balance refers to the relationship between energy in (food consumption) and energy out (physical activity).

- *Positive balance* refers to a situation where energy intake from food exceeds energy expenditure from activity (fat gain).
- *Negative balance* refers to a situation where energy expenditure from physical activity exceeds food intake (fat loss).

In this lesson students examine the impact of lifestyle choices (food intake and physical activity) on energy balance and healthy weight.

Almost everything we eat and drink (except water) contains energy in the form of calories. Human beings need energy to maintain body structures and functions, to grow, and to be active. If less energy is spent in activity than is consumed in food, the body is able to store extra calories in the form of body fat. Reduced levels of physical activity and/or over-consumption of food create *energy imbalance*.

A review of personal food and activity habits will help students identify their own degree of energy balance and make plans for positive change, if appropriate.

REFERENCE



To view a PowerPoint presentation entitled *Finding the Right Balance*, please visit the MPETA website:

Manitoba Physical Education Teachers Association (MPETA). "Nutrition: Energy Balance." *MPETA Resources*. PowerPoint presentation. <www.mpeta.ca/resources.html>.

For website updates, please visit Websites to Support the Grades 11 and 12 Curriculum at <www.edu.gov.mb.ca/k12/cur/physhlth/>.



Specific Learning Outcomes

- 12.NU.5** Explain factors that contribute to energy balance and healthy weight.
- 12.NU.6** Examine the relationship between maintaining healthy weight and the consumption of specific food substances.
Includes: sugar and fat
- 12.NU.7** Demonstrate strategies for making decisions about food and activity choices that contribute to good health and healthy weight.
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Key Understandings

- Different food components provide different amounts of energy.
 - The balance between *energy expenditure* and *energy intake* supports a healthy body and a healthy body weight.
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Essential Question

1. How is energy balance achieved and maintained?
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Background Information

Energy Balance

As noted in Module C, Lesson 2, Health Canada suggests males ages 17 to 18 need between 2450 and 2900 Cal each day. Females of the same age need between 1750 and 2100 Cal each day (Health Canada, “Estimated Energy Requirements”).

The *macronutrients* in food provide the body with calories: carbohydrates and proteins each supply 4 kcal per gram, and fat provides 9 kcal per gram (alcohol provides 7 kcal per gram but should not be considered a positive energy source). The recommended intake for each of these nutrient categories for 14- to 18-year-olds is as follows (Health Canada, *Eating Well with Canada’s Food Guide: A Resource for Educators and Communicators 4*):

- **Protein:** 10% to 30% of daily energy intake
- **Fat:** 25% to 35% of daily energy intake
- **Carbohydrate:** 45% to 65% of daily energy intake

An Acquired Taste

Many people like the taste of sugar and the taste and texture of fat. This is why snack foods and fast foods appeal to many people. It is important for both teenagers and adults to be aware of their intake of high fat and/or sugar-laden (empty calorie) foods, and to have a plan to change the level of consumption, if appropriate.

Sugar Surprise

Sugar occurs naturally in food, and it may be added as an ingredient. Health Canada encourages consumers to limit the intake of foods high in sugar, as they are often also a source of *empty calories* in the diet (i.e., energy without nutrients). In addition, individuals with high sugar consumption are more likely to have relatively poor intake of other important nutrients.

Information on food labels helps consumers to identify sugar in food. The Nutrition Facts table on food labels lists both natural and added sugar as *Sugars* under the heading *Carbohydrate* (see example). The Ingredients list on food labels helps distinguish between added and natural sugars. If there are no sugar items on the Ingredients list, no sugar has been added, and any sugar listed under Carbohydrate on the Nutrition Facts label is present naturally in the food (e.g., grains, fruit, milk, legumes). Items on the Ingredients list ending in *ose* (e.g., sucrose, glucose, fructose) are added sugars, as are syrup, molasses, and so on. Ingredients closer to the beginning of a list are present in larger amounts by weight than those appearing later in the list.

In addition to checking food labels for sugar content, look at the Eat Well box on the back of *Canada's Food Guide* for a list of foods to limit, many of which are high in sugar.

Nutrition Facts *		
Per 1 cup (34 g) cereal		
Amount	Cereal	With 1/2 cup 1 % milk
% Daily Value		
Calories	110	170
Fat 0.5 g	1 %	3 %
Saturated 0 g + Trans 0 g	0 %	4 %
Cholesterol 0 mg		
Sodium 290 mg	12 %	15 %
Potassium 180 mg	5 %	11 %
Carbohydrate 27 g	9 %	11 %
Fibre 5 g	20 %	20 %
Sugars 4 g		
Starch 17 g		
Protein 4 g		
Vitamin A	0 %	8 %
Vitamin C	0 %	0 %
Calcium	2 %	15 %
Iron	30 %	30 %

* Source: Health Canada. "Interactive Nutrition Label and Quiz." *Food and Nutrition*.
<www.hc-sc.gc.ca/fn-an/label-etiquet/nutrition/cons/quiz1-eng.php>.

REFERENCES



For additional information, refer to the following resources:

- Health Canada. *Eating Well with Canada's Food Guide*. Ottawa, ON: Health Canada, 2007. Available online at <www.hc-sc.gc.ca/fn-an/food-guide-aliment/index_e.html>.
- . *Eating Well with Canada's Food Guide: A Resource for Educators and Communicators*. Ottawa, ON: Health Canada, 2007. Available online at <www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/pubs/res-educat-eng.pdf>.
- . "Estimated Energy Requirements." *Food and Nutrition*. 5 Feb. 2007. <www.hc-sc.gc.ca/fn-an/food-guide-aliment/basics-base/1_1_1-eng.php>.

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Suggestion for Instruction / Assessment

Sugar Surprise: How Many Cubes?

For this learning activity, have students use the information on food labels, or nutrition information from restaurants and/or websites, to identify the grams of sugar in various popular large-size beverages and several sweet snack foods.

Directions/Description

- One teaspoon (a cube) of sugar is equal to 4 g, and 1 g equals 4 Cal. With this in mind, students create a graphic representation (e.g., poster, display) of a food item with high sugar content. Have them include
 - the food container, accompanied by a statement of the calories and grams of sugar the food contains
 - the appropriate amount of sugar in a container (e.g., plastic bag) or number of sugar cubes glued below the product
- Students then review the difference in the calorie and sugar content of the super-size version of a product (e.g., a slushy beverage) and a smaller size of the same product.
- Using the Think-Pair-Share learning strategy (see Appendix E), students look at the serving size listed on the Nutrition Facts label of selected snack foods or beverages and compare it to the size of the container. Consider having student answer questions such as the following:
 1. Does the serving size reflect the whole package, or would one consume several servings if one ate the content of the whole package?
 2. Do you think you (consumers) would usually eat only one serving, or would you likely eat the whole thing?
 3. Do you think the serving size listed on snack foods and beverages could mislead consumers? Explain.



Background Information

Fat . . . in Moderation

Fat is an integral part of healthy eating for everyone. It is a source of fat-soluble vitamins (i.e., Vitamins A, D, and E) and essential fats. Fat is part of every cell in the body and helps absorb important nutrients.

Health Canada and the Canadian Paediatric Society encourage a transition from the higher-fat intake of childhood to a pattern of lower-fat eating at the “end of linear growth” or when adult height has been achieved after puberty (Waldron 137). Healthy eating for teenagers should focus on a wide variety of food from all four food groups, with a limited intake of *added fat* (e.g., deep-fried food and snack foods, donuts, pastries, sauces, gravies). For adults, lower-fat eating has been associated with good health.

Essential Fats

Canada's Food Guide recognizes the importance of consuming *essential fats*. These fats must come from food, as our bodies cannot produce them. They are necessary to manufacture and repair cell membranes throughout the body, especially brain and nerve cells and eyes. Consuming a small amount (30 to 45 mL) of oil, such as canola, olive, or soybean oil, each day (e.g., in stir-fries, salad dressing) ensures a source of these important fats for our bodies.

Trans Fats

Trans fats occur naturally in foods and are created artificially in commercial processing of oils into solid fat through a process called *hydrogenation*. Consuming industrially created trans fats increases the risk of heart disease, as it increases the *bad* low-density lipoprotein (LDL) cholesterol in the blood, and decreases the *good* high-density lipoprotein (HDL) cholesterol in the blood. The report of the Trans Fat Task Force (Health Canada) recommends limiting trans fat consumption.

Nutrition Facts *		
Per 1 cup (34 g) cereal		
Amount	Cereal	With 1/2 cup 1 % milk
% Daily Value		
Calories	110	170
Fat 0.5 g	1 %	3 %
Saturated 0 g	0 %	4 %
Trans 0 g	0 %	4 %
Cholesterol 0 mg		
Sodium 290 mg	12 %	15 %
Potassium 180 mg	5 %	11 %
Carbohydrate 27 g	9 %	11 %
Fibre 5 g	20 %	20 %
Sugars 4 g		
Starch 17 g		
Protein 4 g		
Vitamin A	0 %	8 %
Vitamin C	0 %	0 %
Calcium	2 %	15 %
Iron	30 %	30 %

* Source: Health Canada. "Interactive Nutrition Label and Quiz." *Food and Nutrition*. <www.hc-sc.gc.ca/fn-an/label-etiquet/nutrition/cons/quiz1-eng.php>.

NOTE TO TEACHER

Small amounts of trans fat occur *naturally* in animal-based foods, such as dairy products, beef, and lamb. These naturally occurring fats are excluded in the Trans Fat Task Force recommendations.

REFERENCES



For additional information, refer to the following resources:

Health Canada. *TRANSforming the Food Supply: Final Report of the Trans Fat Task Force*. Ottawa, ON: Health Canada, June 2006. Available online at <www.hc-sc.gc.ca/fn-an/nutrition/gras-trans-fats/tf-ge/tf-gt_rep-rap-eng.php>.



Joint Working Group of Canadian Paediatric Society (CPS) and Health Canada. *Nutrition Recommendations Update: Dietary Fat and Children*. Ref. No. N94-01. Approved by CPS Board of Directors 1994, reaffirmed March 2004.

Waldron, Sheridan. "Dietary Education and Outcomes for Young People with Type 1 Diabetes." *Canadian Journal of Diabetes* 29.2 (2005): 133–41. Available on the Canadian Diabetes Association website at <www.diabetes.ca/Files/Waldron--FINAL.pdf>.

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Suggestion for Instruction / Assessment

Find the Fat

Snack foods, pastries, gravies, sauces, and food-preparation methods (e.g., deep frying) add fat to our diets every day, often without our realizing how much.

The information on the Nutrition Facts table on food labels helps consumers make decisions about food. Each food label must identify a serving size and a list of nutrients present in that amount of the food, including fat.

To help students identify common sources of high-fat snacks and foods, have them compare different types of foods and different serving sizes of the same foods, and record their results using RM 7–NU.

Examples of foods to compare:

- commercial French fries and oven-baked fries
- varieties of air-popped popcorn
- potato chips and other snack foods (baked and fried)
- battered deep-fried chicken and broiled or baked chicken
- donut and small bagel or English muffin

For this food-comparison task, have students use the information from

- Nutrition Facts labels
- comprehensive nutrient tables (e.g., see Health Canada, *Nutrient Value of Some Common Foods*)
- websites of individual fast food restaurants



Refer to RM 7–NU: Find the Fat.

NOTE TO TEACHER

Consider having students visit a supermarket to give them an opportunity to investigate a variety of food products in different sizes, with different preparation methods (e.g., baked, not fried).

REFERENCE



For additional information, refer to the following resource:

Health Canada. *Nutrient Value of Some Common Foods*. Ottawa, ON: Health Canada, 2008. Available online at <www.hc-sc.gc.ca/fn-an/nutrition/fiche-nutri-data/nutrient_value-valeurs_nutritives-eng.php>.

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Background Information

The Balancing Act

Canadian adolescents and adults are finding it increasingly difficult to maintain a healthy body weight. With easy and constant access to food and a decreasing need to move while accomplishing daily activities, energy output and input are frequently out of balance, making it easy to store extra body fat.

Factors Associated with Energy Imbalance	Ideas to Fix Energy Imbalance
<p>Over-consumption of food related to</p> <ul style="list-style-type: none">▪ availability of super-size portions of fast foods▪ taste for flavour of foods high in sugar and fat▪ availability of fatty, overly sweet, low-nutrient snack foods▪ abundance, convenience, visibility, and attractive packaging of foods▪ food promotions and advertising▪ role models and influences▪ lack of understanding about energy content of foods▪ eating while doing something else (e.g., watching TV)	<p>Ideas for reasonable food consumption</p> <ul style="list-style-type: none">▪ avoid choosing super-size portions▪ enjoy tasty food in reasonable portions▪ eat nutritious snack foods▪ be aware of food packaging and promotions and their purpose (e.g., to increase the amount or size of the food items we chose to buy)▪ check the energy content on food labels▪ avoid eating while doing something else (e.g., homework)
<p>Lack of physical activity related to</p> <ul style="list-style-type: none">▪ time spent watching TV, using computers, doing other on-screen activities, sitting in class▪ time management—too busy to exercise (e.g., “need” to work)▪ concern about personal safety▪ transportation (e.g., I used to walk to school, now I drive every day)▪ other activities and responsibilities▪ lack of motivation▪ shortage of money (e.g., can't afford to register for hockey league)	<p>Ways to become more active</p> <ul style="list-style-type: none">▪ set a limit to TV and computer time▪ walk rather than drive, if possible▪ find an activity you enjoy, and do it regularly▪ play with children if you babysit or have younger siblings▪ find a friend to be active with▪ try to avoid choices that, over time, significantly change energy balance (e.g., driving regularly instead of walking)▪ participate in free or low-cost activities



Suggestions for Instructions / Assessment

The Balancing Act

As students move into young adulthood, they may not realize how changes in their day-to-day routines affect opportunities for food intake and energy expenditure. The following learning activities are intended to help students recognize personal energy imbalance, reflect on what caused the imbalance, and identify realistic opportunities for improvement.

Energy Imbalance

Ask students how they think energy imbalance happens in teenagers' lives. Initially, imbalances can be small and unnoticed, but over months and years, they can add up to weight gain and the many health problems that plague so many Canadians today.

Ask students to identify factors that contribute to energy imbalance and potential weight gain in themselves, family members, friends, and society in general. The factors can be either food related or activity related (see examples provided in Teacher Background). Record student comments on the left side of an overhead projection of RM 8–NU. The right side will be completed in *Fixing Energy Imbalance* (see below). This information will be used in Final Tally (see next page).

NOTE TO TEACHER

Treat the topic of potential weight gain with sensitivity, as issues of body image and self-esteem may arise. Potentially sensitive content is to be treated in ways that are appropriate for the local school, school division, and community context.



Refer to RM 8–NU: Some Lifestyle Choices Can Lead to Energy Imbalance—How Does It Happen?

Fixing Energy Imbalance

Now that factors associated with energy imbalance have been identified and recorded, ask students how they think this imbalance can be overcome (e.g., How can teenagers spend more energy being active, or make food choices that better reflect daily energy needs?). Encourage students to make suggestions they think are realistic for *them*. Record student comments on the right side of RM 8–NU.



Refer to RM 8–NU: Some Lifestyle Choices Can Lead to Energy Imbalance—How Does It Happen?

Final Tally

Students will refer to information and assessments from previous lessons and generate a personal plan to modify energy imbalance, if appropriate.

Provide each student with a copy of RM 9–NU: My Lifestyle Choices and Energy Balance. Students work individually in completing this RM.

■ *Food Consumption*

- Working individually, students review their record of food intake and accompanying healthy eating goal, as noted in RM 3–NU: How Do I Measure Up? (see Module C, Lesson 1). They also consider what they learned about their own food choices in the Sugar Surprise and Find the Fat learning activities suggested earlier in this lesson.
- Students identify food habits (or factors related to how/why they choose foods) that may contribute to energy imbalance, listing the factors on the left side of RM 9–NU. (Students may refer to the class list from RM 8–NU to help generate their own list.) On the right side of RM 9–NU, students identify an action that will help them counter the impact of each factor they recorded related to food choices, if appropriate.

■ *Physical Activity*

- Students review the average number of hours they spent per day in activities of moderate and vigorous intensities, as calculated in step 4 of RM 6–NU: Determining Daily Physical Activity Intensities (see Module C, Lesson 2). Remind students that *Canada's Physical Activity Guide for Youth* (Public Health Agency of Canada) recommends 90 minutes of daily physical activity (at least 60 minutes of moderate activity and 30 minutes of vigorous activity).
- On the left side of RM 9–NU, students identify factors that may contribute to energy imbalance with respect to lack of physical activity, keeping in mind the goal identified in *Canada's Physical Activity Guide for Youth*. (Students may refer to the class list from RM 8–NU to help generate their own list.) On the right side of RM 9–NU, students identify an action that will help them counter the impact of each factor they recorded related to physical activity, if appropriate. These actions may be linked to the OUT-of-class activities students choose for their physical activity plan.

NOTE TO TEACHER

Of the 90 minutes of physical activity, 30 minutes should be of vigorous intensity and 60 minutes should be of moderate intensity. This activity does not have to come from one bout of exercise, but can be accumulated from brief intervals throughout the day (e.g., climbing stairs, walking to and from school). The accumulation of more physical activity time per day may require setting shorter-term goals that work toward more physical activity and less “non-active” time.

- *A Personal Plan*
 - Students reflect on their personal learning in Module C, Lessons 1 to 3, and the solutions generated in Food Consumption and Physical Activity on the previous page.
 - Students write a paragraph at the bottom of RM 9–NU, outlining what they have learned about themselves and energy balance and reflecting upon positive changes they can realistically implement in their daily lives with respect to food choices and physical activities. They indicate where they can make positive changes and what they plan to do.



Refer to the following RMs:

RM 3–NU: How Do I Measure Up?

RM 6–NU: Determining Daily Physical Activity Intensities

RM 8–NU: Some Lifestyle Choices Can Lead to Energy Imbalance—How Does It Happen?

RM 9–NU: My Lifestyle Choices and Energy Balance

REFERENCE



For additional information, refer to the following resource:

Public Health Agency of Canada. *Canada's Physical Activity Guide for Youth*. Ottawa, ON: Public Health Agency of Canada, 2002. Available online at <www.phac-aspc.gc.ca/pau-uap/fitness/downloads.html>.

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