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Eating Well with Canada's Food Guide (2007): Development of the Food Intake Pattern

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A food intake pattern specifying amounts and types of food was created for Canada's revised food guide, Eating Well with Canada's Food Guide (2007)*, using a two-step modeling process. In step one, food composites were manipulated to develop a food intake pattern. The second step used the step one food intake pattern to create 500 simulated diets for each of 16 age and gender groups. The resulting nutrient content distributions were evaluated relative to Dietary Reference Intake reference values. The modeling cycled between these two steps until a satisfactory pattern was achieved. The final pattern reflects modeling, a review of associations between foods and chronic disease, and input received during consultation.*

Key words: Canada's food guide, DRI assessment, food intake patterns, modeling

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BACKGROUND

The federal Health Department introduced Canada's first food guide, called *Canada's Official Food Rules*, in 1942. Since then, the Food Guide has been transformed many times and has adopted new names, new looks, and new messages, yet has never waivered from its original purpose of guiding food selection and promoting the nutritional health of Canadians.[1]

Since *Canada's Food Guide to Healthy Eating* was released in 1992, science concerning the relationship between diet and health has evolved. To examine whether Health Canada's guidance was consistent with the latest science and well understood by its users, a review of the Food Guide was undertaken in late 2002. The review included an assessment of diets that follow a pattern of eating recommended by the Food Guide, a review of changes in the food supply, an evaluation of the use and understanding of the Food Guide by teachers, dietitians, and public health personnel, and a national stakeholder consultation.

A revision was undertaken in 2004 to address some of the challenges identified in using the 1992 Food Guide while building on its strengths. Identified strengths included its flexibility, simplicity, visual appeal, widespread awareness, and its consistency with current science. Challenges included confusion about serving sizes and serving ranges, unclear terms such as "moderation," the perception that the graphics were outdated and not sufficiently inclusive of multicultural foods, and concern that the "Other Foods" category was too vague.

The purpose of the Food Guide is to assist the people of Canada in making food choices that promote health and reduce the risk of nutrition-related chronic disease. The Food Guide reflects the food supply available to and food choices made by Canadians. It promotes a desirable pattern of eating rather than prescribing a dietary pattern.

Development of the food intake pattern for the revised Food Guide built on findings from the review of

the 1992 Food Guide, the nutrient standards and assessment methods provided in the Dietary Reference Intakes (DRI) reports of the Institute of Medicine,[2-8] evidence looking at the relationship between select foods and risk of chronic disease, and stakeholder feedback.

The focus of this paper is to provide information on the development of the food intake pattern: the amounts and types of food recommended in the revised Food Guide.

PROCESS TO DEVELOP THE FOOD INTAKE PATTERN

A food intake pattern was created using the two-step modeling process shown in Figure 1. In the first step, food composites were created and manipulated until a food intake pattern with satisfactory average nutrient levels was found for each of 16 age and gender groups. In the second step, the food intake pattern from the first step was used to create 500 simulated diets for each of these age and gender groups. The nutrient distributions from these simulated diets were assessed relative to the appropriate DRI reference values. When assessment of these simulated diets yielded less than satisfactory results, step one was revisited to try to produce a better pattern. A revised food intake pattern then informed the creation of further simulated diets. The modeling cycled between steps one and two until no further adjustments to the food intake pattern were needed. The food intake pattern was also reviewed for consistency with associa-

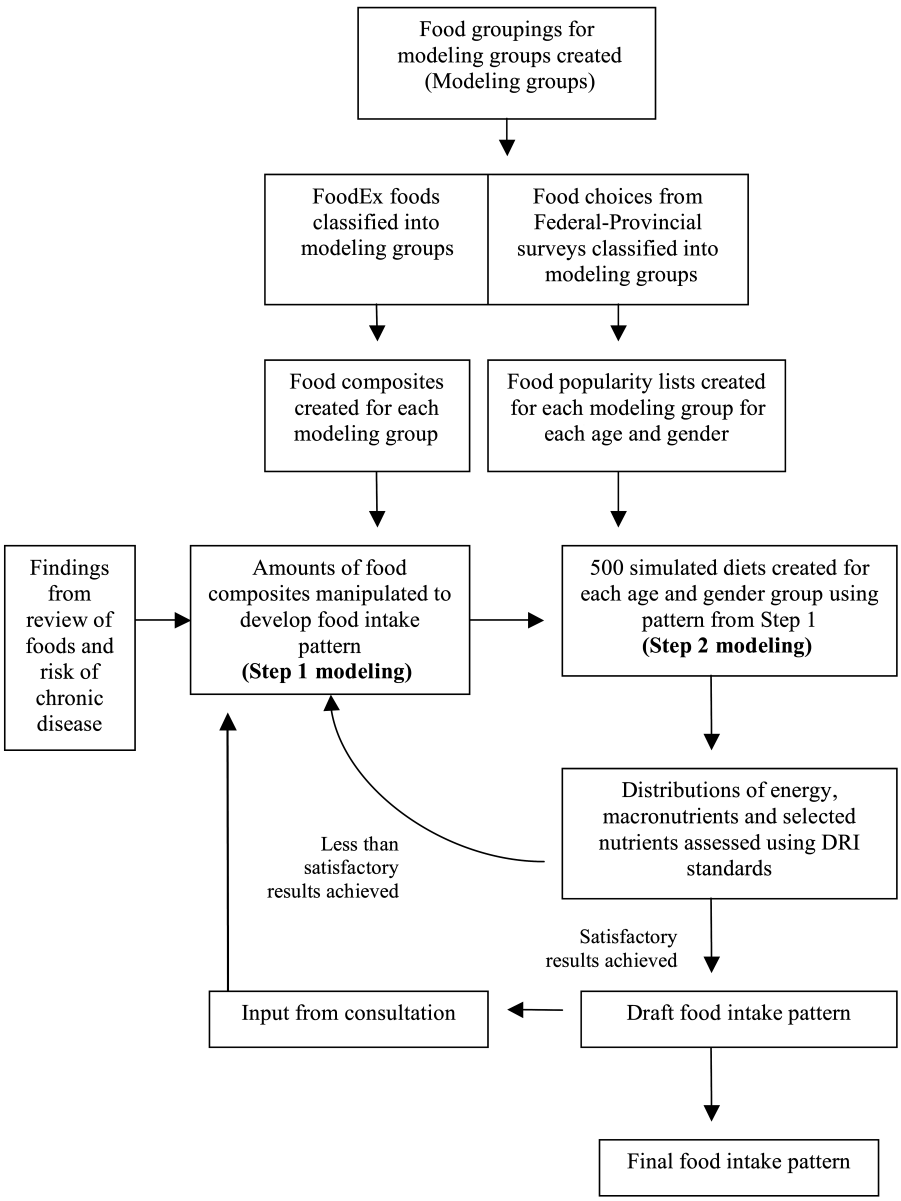

Figure 1. Process to develop the food intake pattern for *Eating Well with Canada's Food Guide (2007).*

tions between foods and risk of chronic disease. Lastly, the draft food intake pattern was shared publicly during a consultation period. The final food intake pattern reflects modeling to achieve nutrient adequacy, the review of associations between foods and risk of chronic disease, and input received during consultation. Details of the process to develop the food intake pattern follow.

Food Groupings for Modeling

Food groupings for modeling (herein referred to as modeling groups) were created for food intake pattern development using the food groups and directional statements (statements guiding food choice such as "choose lower-fat milk products more often") from the 1992 Food Guide as a starting point. Food groups in the Food Guide have evolved over time, but generally reflect the food supply and its use. In 1992, foods were classified into four food groups and the "Other Foods" category primarily on the basis of these factors[9]:

- Commodity or Agricultural Base – Foods originating from the same agricultural base were generally grouped together. For example, wheat as a grain, wheat flour and foods made with wheat flour such as breads, pasta, and muffins were grouped together in "Grain Products."
- Consumer's Use of Foods and How Foods Have Been Traditionally Classified – For example, legumes were placed in "Meat and Alternatives" because consumers often used them as a substitute for meat. If food classification had been based on only nutrient similarity, legumes would have been grouped with "Grain Products."
- The Fact That Some Food Items Do Not Fit into a Food Group – Foods that did not fit into any of the four food groups were classified into the "Other Foods" category.

Additional modeling groups were developed as shown in Table 1. Modeling groups enabled the assessment of the impact of recommending specific types of foods. For example, the impact of favoring fruit juice rather than fruit on the fiber content of diets could be assessed. Similarly, it was possible to explore the impact of recommending fruits rather than vegetables on the folate, vitamin A, and vitamin C content of diets. Modeling groups used in the final food intake pattern are shaded in Table 1.

Foods Classified into Modeling Groups

Two different data sets were used for steps one and two of the modeling process. Statistics Canada's 2001 Food Expenditure Survey (FoodEx) provided estimates of quantities of food purchased by households, which were subsequently converted to estimates of (edible) amounts available to each individual. A list of over 200 food categories was used.

At the time of the Food Guide revision process, no national data existed on what Canadians were eating. Data for simulating diets were therefore based on food choices documented in the four most recent Federal-Provincial food and nutrition surveys (British Columbia, Manitoba, and Ontario surveys for adult data, and the Quebec youth survey for children's data). The Federal-Provincial surveys databases, compiled from one-day recalls, provided a pool of detailed food choices by over 6000 individuals, from which simulated diets could be created.

Foods from both data sets were classified into the modeling groups. The assignment of foods from both the FoodEx and Federal-Provincial surveys datasets was cross-verified to ensure consistency in classification.

An adapted version of the 1997 Canadian Nutrient File (CNF) was used as the source of energy and nutrient values for foods. This database reflects nutrients found in foods as they appear in the Canadian marketplace, and the mandatory addition of nutrients to food. Nutrients for which data in the CNF were insufficient were not included in the modeling process. For most foods, the serving sizes assigned were consistent with those used in the document *Relating Canada's Food Guide to Healthy Eating to Canadian Nutrient File Foods*.[10]

Food Composites Created for Each Modeling Group for Use in Step One Modeling

Food composites were created for each modeling group and subgroup. To create the composite, the relative importance of each FoodEx food in each modeling group was established. This information was then used to determine the relative nutrient content of each food item in the composite. For example, if the FoodEx data showed that of the total amount of fruit purchased, 50% was oranges, 25% was apples, and 25% was bananas, then the nutrient content of the fruit composite was based on the relative importance of the individual foods in this group. Therefore, 50% of the fruit composite's nutrient profile was based on the nutrients in one serving of oranges, 25% on the nutrients in one serving of apples, and another 25% on the nutrients in one serving of bananas. The result was a representative nutrient profile for one serving of the fruit composite.

For any individual food, its relative importance changed depending on which modeling group or subgroup was used. The importance of oranges in the "Vegetables and Fruit" group, for example, would be less than its relative importance in the "Fruit and Juices" modeling subgroup, where vegetables are excluded.

Table 1. Food Groupings for Modeling (Modeling Groups) to Develop *Eating Well with Canada's Food Guide (2007)

Vegetables and Fruit	Vegetables	Dark green vegetables
		Orange vegetables
		Higher-fat potato choices
		Lower-fat potato choices
		Other vegetables
	Fruit and juices	Fruit
		Juices
Grain Products	Whole grain products	Higher-fat whole grains
		Lower-fat whole grains
	Non-whole grain products	Higher-fat non-whole grains
		Lower-fat non-whole grains
Milk and Alternatives	Fluid milk and fortified plant-based beverages	Higher-fat fluid
		Lower-fat fluid
	Milk products	Higher-fat other
		Lower-fat other
Meat and Alternatives	Fresh and processed meat	Higher-fat fresh meat
		Lower-fat fresh meat
		Processed meat
	Fresh and processed fish and shellfish	
	Eggs	
	Pulses/alternatives *Legumes, peanuts, tofu, and meat analogs*	
	Nuts and nut products *Excludes peanuts; includes sunflower and other seeds*	
Foods outside of the four food groups	Fats	Saturated fats *Butter, shortening, cream cheese, stick margarine, whipping cream, etc.*
		Unsaturated fats *Tub margarine, vegetable oils, salad dressings, mayonnaise, etc.*
	Confectionaries and sugars *Sugar, frozen desserts, pies, candies, chocolate coated granola bars, Danish pastries, etc.*	
	Non-alcoholic beverages	Higher calorie *Carbonated beverages, fruit drinks, hot chocolate made with water, etc.*
		Lower calorie *Coffee, tea, artificially sweetened drinks, etc.*
	Salty snack foods *Potato chips, tortilla chips, popcorn, pretzels, etc.*	
	Alcoholic beverages	
	Other/miscellaneous *Condiments, spices, etc.*	

* Selected examples shown in italics. Food groupings for modelling used in the final food intake pattern are shaded.

Amounts of Food Composites Manipulated to Develop Food Intake Pattern – Step One Modeling

Once food composites were created, the goal was to establish amounts of food composites to create a food intake pattern for each age and gender group. The number of servings of each food composite was increased or decreased for each age and gender group until a food intake pattern with satisfactory average nutrient levels was achieved. The lower number of servings recommended in the 1992 Food Guide was

used as a starting point for developing the food intake pattern.

Not all modeling groups were used in every iteration of modeling. For instance, the first model used the following food composites: "Vegetables and Fruit," "Grain Products," "Milk and Alternatives," and "Meat and Alternatives." When satisfactory results could not be achieved, food composites representing more specific modeling subgroups were tested. For example, instead of specifying a number of servings of "Grain Products" in general, a number of servings of whole grains and non-whole grains were tried. Increasing the level of specificity at which modeling occurred allowed better nutrient outcomes to be achieved with less food and fewer calories.

Because nutrient requirements vary by age and gender, a separate food intake pattern was developed for each of the DRI age and gender groups for those 2 years of age and older. These age and gender groups include: 2–4 years and 4–8 years; then for males and females separately 9–13 years, 14–18 years, 19–30 years, 31–50 years, 51–70 years, and 71 years and older. The same food composites were used for all age and gender groups. Once a food intake pattern with satisfactory average nutrient levels was established in step one, the pattern was used for developing simulated diets in step two.

Food Popularity Lists Created for Each Modeling Group for Use in Step Two Modeling

To create simulated diets using individual food choices from Federal-Provincial surveys, the relative importance or popularity of each food within a modeling group was determined for each of the different age and gender groups. This was so that the probability of any food being included in a simulated diet would be proportional to its use in a given age and gender group.

Simulated Diets Created – Step Two Modeling

Using the food intake pattern established in step one of modeling as a template, 500 simulated diets were created for each age and gender group to estimate the nutrient distributions. Individual foods were chosen randomly from the modeling groups specified in step one, with the probability of the selection of any individual food based on the relative popularity of the food for a given age and gender group. For example, if lettuce represented 8% of vegetables eaten by women 31–50 years of age, then when simulated diets were created for this age and gender group, there was an 8% chance that lettuce would be randomly selected as a serving of vegetables. For men 19–30 years of age, however, lettuce may only have represented 5% of vegetables eaten, so lettuce would appear less frequently in the simulated diets for this age and gender group. Table 2 shows how the relative popularity of foods changes as modeling groups get more specific.

Nutrient and Energy Content of Simulated Diets Assessed

Distributions of micronutrient, macronutrient, and energy content of the simulated diets were assessed relative to the appropriate DRI values to inform the further adjustment of the food intake pattern. An iterative process was followed to adjust the food intake pattern. Adjustments were made in step one modeling, followed by reassessment of the pattern through the creation of simulated diets.

More specifically, the following criteria were used in assessment:

- For vitamins and minerals with an Estimated Average Requirement (EAR), there should be a low prevalence (<10%) of diets with nutrient content below the EAR. A threshold of 10% was used because the simulated nutrient distributions were not adjusted to estimate "usual" nutrient content. Nutrients assessed were folate, magnesium, niacin, phosphorus, riboflavin, thiamin, vitamin A, vitamin B_6, vitamin B_{12}, vitamin C, zinc, and iron. The full probability method was used when assessing iron content.
- For nutrients with an Adequate Intake (AI), the median nutrient content of simulated diets should approximately equal the AI. Nutrients assessed with an AI were calcium, linoleic acid, alpha-linolenic acid, potassium, sodium, fiber, and vitamin D.
- For macronutrients, the majority (≥80%) of simulated diets should have carbohydrate, fat, and pro-

Table 2. Popularity (%) of the Top Five Foods Within the "Vegetables and Fruit" Modeling Group for Women 51–70 Years of Age Used to Develop *Eating Well with Canada's Food Guide (2007)*

Vegetables and Fruit	Vegetables	Dark Green Vegetables
Bananas, raw, 5.6%	Lettuce, salad, 8.2%	Broccoli, boiled, 19.7%
Lettuce, salad, 4.8%	Tomatoes, raw, 6.6%	Lettuce, romaine, 14.3%
Tomatoes, raw, 3.8%	Soup, vegetable, 4.6%	Cucumber, raw + peel, 13.9%
Apples, raw, 3.7%	Broccoli, boiled, 3.1%	Peas, green, 6.5%
Soup, vegetable, 2.7%	Cabbage, raw, 2.9%	Peppers, green, 6.5%

tein content within the lower and upper bounds of the Acceptable Macronutrient Distribution Ranges (AMDRs). The choice of 80% of diets within the AMDR as a benchmark allows for 10% of diets to have nutrient content below the lower bound and 10% of diets to have nutrient content above the upper bound, given that the simulated nutrient distributions were not adjusted to estimate "usual" nutrient content.

- The DRI reports do not quantify recommendations for saturated fat and dietary cholesterol, suggesting that diets should be as low as possible in these nutrients without adversely affecting the nutrient adequacy of the diet. Benchmarks of 10% or less of calories from saturated fat and 300 mg or less of dietary cholesterol were used in assessing the median nutrient content of simulated diets.
- For nutrients with a Tolerable Upper Intake Level (UL), there should be an absence of diets with nutrient content at or above the UL.
- The median energy content of simulated diets should be at or below the Estimated Energy Requirement (EER) calculated for reference individuals using a sedentary level of activity. Measured heights and weights from the Canadian Community Health Survey, Cycle 2.2,[11] were used to determine median height and median normal weight for each age and gender group. These were then used as inputs to the EER equations. A sedentary level of activity was considered most appropriate so that there was no overestimation of requirements.

Food intake patterns meeting these criteria have a high probability of nutrient adequacy and appropriate macronutrient balance and a low probability of nutrient excess within an appropriate amount of energy.

Nutrient, macronutrient, and energy distributions were evaluated at key intervals by expert advisors to the food intake pattern development process. Deviations from these criteria were tolerated when either the limitations of the DRI standard or the databases upon which distributions were created were taken into consideration.

Review of Some Foods and Their Association with Chronic Disease Risk

As well as modeling steps, a review of the evidence around food and risk of chronic disease provided additional information to develop the food intake pattern. The World Health Organization/Food and Agriculture Organization of the United Nations (WHO/FAO) *Joint Report on Diet, Nutrition and the Prevention of Chronic Diseases*, including the background papers in the journal *Public Health Nutrition*, and the *2005 Dietary Guidelines Advisory Committee Report*, were reviewed for convincing evidence on the association of foods and chronic disease risk.[12-20]

Consultation

Consultation on a draft food intake pattern and the manner in which it was communicated was undertaken. Feedback from stakeholders contributed to the final food intake pattern. Although amounts of food were specified for individual age and gender groups, some stakeholders compared the lowest and highest number of servings recommended over all age and gender groups to the former range of servings in the 1992 Food Guide. This resulted in the perception that the revised food intake pattern was de-emphasizing the importance of vegetables and fruit and suggesting an increase in the consumption of meat.

Adjustments to the food intake pattern were made to address these issues. The number of servings of "Vegetables and Fruit" was increased from 9 to 10 servings in men 19–30 years of age. Furthermore, the size of a Food Guide Serving of "Meat and Alternatives" was adjusted from 50 g to 75 g with a subsequent adjustment downward in the number of Food Guide Servings of "Meat and Alternatives." The total amount of "Meat and Alternatives" recommended was similar to that put forward in the draft food intake pattern, but the number of servings no longer appeared to be greater than in the past. Simulated diets were created to assess the impact of these changes. Furthermore, stakeholder feedback led to placing increased emphasis on sodium by providing clear messages to help consumers reduce sodium intake.

RESULTS

The results of the review of the reports on foods and chronic disease risk revealed convincing evidence on the relationships between: 1) consumption of vegetables and fruit and reduced risk of cardiovascular disease and cancer; 2) consumption of whole grains and reduced risk of cardiovascular disease; 3) consumption of milk products and reduced risk of osteoporosis; and 4) consumption of fish, particularly fatty fish, and reduced risk of cardiovascular disease. Throughout the modeling process these associations were taken into consideration.

After the assessment of more than 50 food intake patterns, a final food intake pattern for 16 age and gender groups emerged and is shown in Table 3. In order to achieve satisfactory nutrient outcomes within a conservative number of calories, the pattern needed to specify particular amounts and types of foods. Statements reflecting the types of foods used in modeling, findings from the review of foods and chronic disease risk, and input from consultation are shown in Table 4.

Table 3. *Eating Well with Canada's Food Guide (2007)*: Number of Food Guide Servings for Males and Females by Age								
	Age in Years							
	2–3	4–8	9–13	14–18	19–30	31–50	51–70	71+
Males								
Vegetables and Fruit	4	5	6	8	10	8	7	7
Grain Products	3	4	6	7	8	8	7	7
Milk and Alternatives	2	2	3–4	3–4	2	2	3	3
Meat and Alternatives	1	1	2	3	3	3	3	3
Unsaturated Fat (g)	30	30	30	45	45	45	45	45
Females								
Vegetables and Fruit	4	5	6	7	8	7	7	7
Grain Products	3	4	6	6	7	6	6	6
Milk and Alternatives	2	2	3–4	3–4	2	2	3	3
Meat and Alternatives	1	1	1	2	2	2	2	2
Unsaturated Fat (g)	30	30	30	30	30	30	30	30

Simulated diets that followed the food intake pattern, which includes the statements, yielded satisfactory results across all nutrients and macronutrients examined as well as energy. For nutrients with an EAR—folate, iron, magnesium, niacin, phosphorus, riboflavin, thiamin, vitamin A, vitamin B_6, vitamin B_{12}, vitamin C, and zinc—the prevalence of inadequate nutrient content in simulated diets was less than 10%. A sample distribution output (for folate) showing nutrient content of simulated diets across a range of percentiles is shown in Table 5. See Table 6 for a summary of results for nutrients assessed with an EAR.

For calcium, alpha-linolenic acid, and vitamin D (except for those older than 50 years), the median nutrient content of the simulated diets approximately met the AI. See Table 7 for vitamin D content of simulated diets.

With the exception of sodium, the nutrient content of simulated diets was below the UL. See Table 8 for median sodium content of simulated diets. The assessment of simulated diets relative to macronutrients yielded satisfactory results. See Table 9 for saturated fat content of simulated diets. Nutrients for which less than perfect results were accepted after discussion with experts and advisors included: linoleic acid, potassium, fiber (particularly for children), and energy in certain age groups. The energy content of simulated diets is shown in Table 10.

DISCUSSION

Methodological Considerations

The two-step method used to develop the food intake pattern builds on traditional methods of developing food guides and makes use of the DRI values and assessment methodology recommended in the DRI reports.

The use of food composites in step one provided a relatively quick and simple way to test different combinations of types and amounts of foods to generate a food

Table 4. *Eating Well with Canada's Food Guide (2007)*: Food Intake Pattern Statements	
Food Group	**Statement**
Vegetables and Fruit	Eat at least one dark green and one orange vegetable each day.
	Choose vegetables and fruit prepared with little or no added fat, sugar or salt.
	Have vegetables and fruit more often than juice.
Grain Products	Make at least half of your grain products whole grain each day.
	Choose grain products that are lower in fat, sugar or salt.
Milk and Alternatives	Drink skim, 1%, or 2% milk each day.
	Select lower fat milk alternatives.
Meat and Alternatives	Have meat alternatives such as beans, lentils and tofu often.
	Eat at least two Food Guide Servings of fish each week.
	Select lean meat and alternatives prepared with little or no added fat or salt.
Oils and Fats	Include a small amount – 30 to 45 mL (2 to 3 Tbsp) – of unsaturated fat each day. This includes oil used for cooking, salad dressings, margarine and mayonnaise.

Table 5. Distribution of Folate Content of Simulated Diets (Dietary Folate Equivalents) Based on *Eating Well with Canada's Food Guide (2007)*

Gender/ Age (y)	Mean	P1	P5	P10	P25	P50	P75	P90	P95	P99	EAR	% Below EAR
M 2–3	244	114	142	162	193	234	280	329	351	610	120	1.2
M 4–8	301	161	195	213	243	292	337	386	426	844	160	1.0
M 9–13	433	272	314	338	377	420	470	533	580	688	250	0.4
M 14–18	540	359	400	418	468	524	587	657	713	793	330	0.2
M 19–30	632	424	492	513	559	623	689	748	796	903	320	0.0
M 31–50	575	369	416	447	500	559	627	695	735	1167*	320	0.0
M 51–70	491	306	347	374	421	480	547	623	662	721	320	1.6
M 71+	472	282	329	350	406	461	537	599	643	752	320	3.6
F 2–3	250	124	146	166	194	233	287	349	390	570	120	0.6
F 4–8	300	181	201	224	253	290	333	380	434	562	160	0.4
F 9–13	426	259	299	320	353	406	470	523	566	1260*	250	0.4
F 14–18	461	310	337	359	408	456	505	559	602	682	330	3.4
F 19–30	516	338	370	394	442	504	571	648	698	803	320	0.4
F 31–50	452	290	321	339	387	445	502	558	604	785	320	4.8
F 51–70	446	280	315	343	382	438	494	561	603	711	320	6.0
F 71+	432	271	309	325	367	414	479	564	614	752	320	8.0

*Most of the folate in the food intake pattern comes from natural sources, so the folate content of simulated diets at the 99th percentile for selected age and gender groups does not exceed the Tolerable Upper Intake Level (which for folate applies to synthetic forms).
EAR, Estimated Average Requirement; P, percentile.
% Below EAR = prevalence of diets with nutrient content below the EAR.

intake pattern. However, because composites were representative, single values, it was like creating one single representative diet for each age and gender group, and the variability due to individual food selection was not taken into account.

The methodology used in step two recognized that a distribution of nutrient intakes results from following a proposed pattern. Simulating Food Guide-consistent diets and evaluating the resulting nutrient distributions provided concrete support to the statement that the food intake pattern met nutrient needs, promoted health, and helped to reduce the risk of nutrition-related chronic disease.

A low prevalence of inadequate nutrient content or nutrient excess in Food Guide-consistent diets implies that for any individual person following the Food Guide, the probability that their own nutrient requirements are not met or that nutrient excess occurs is also low. Because of this, it can be said that this Food Guide is suitable for use by individuals.

Development of the food intake pattern was rooted in the food choices of Canadians. The use of popularity lists from selected Federal-Provincial surveys ensured that, as much as possible, the recommendations reflected the foods selected by Canadians. For example, when lower-fat fluid milk was specified, simulated diets included a selection of skim, 1%, and 2% milk, as defined by relative popularity.

The challenge of increasing incidence of overweight and the importance of preventing obesity was considered carefully. The approach used consisted of meeting nutrient requirements and then assessing the energy distribution of the simulated diets against reference values assuming a sedentary level of activity.

Development of Guidance on Types of Food in the Food Intake Pattern

Throughout the course of modeling, it was found that some nutrients were prevalent throughout the food supply and adequacy was achieved quite easily. However, there were nutrients for which adequate amounts could not be achieved within a reasonable amount of energy without having more specific guidance on the quality of food choices. Specifying the inclusion of particular subgroups of foods improved the nutrient profile of diet patterns without increasing the total amount of food recommended. Statements highlighting particular subgroups were included in the final food intake pattern for specific reasons:

- "Eat at least one dark green and one orange vegetable each day": Dark green and orange vegetables were needed to achieve adequate levels of folate and vitamin A in the food intake pattern.
- "Have vegetables and fruit more often than juice": Vegetables and fruit were recommended more often

Table 6. Summary of Percent of Simulated Diets with Nutrient Content Below Estimated Average Requirement Based on *Eating Well with Canada's Food Guide (2007)*						
Gender/ Age (y)	**Folate**	**Magnesium**	**Niacin**	**Phosphorus**	**Riboflavin**	**Thiamin**
M 2–3	1.2	–	–	–	–	–
M 4–8	1.0	–	–	–	–	–
M 9–13	0.4	–	–	–	–	–
M 14–18	0.2	1.0	–	–	–	–
M 19–30	–	–	–	–	–	–
M 31–50	–	6.4	–	–	–	–
M 51–70	1.6	7.8	–	–	–	–
M 71+	3.6	12.0*	–	–	–	–
F 2–3	0.6	–	–	–	–	0.2
F 4–8	0.4	–	–	–	–	–
F 9–13	0.4	–	–	1.2	–	–
F 14–18	3.4	3.6	–	–	–	–
F 19–30	0.4	0.2	–	–	–	–
F 31–50	4.8	3.6	–	–	–	–
F 51–70	6.0	1.0	–	–	–	–
F 71+	8.0	0.8	–	–	–	–
	Vitamin A	**Vitamin B_{12}**	**Vitamin B_6**	**Vitamin C**	**Zinc**	**Iron†**
M 2–3	–	–	–	0.2	–	2.6
M 4–8	–	–	–	0.4	0.2	3.5
M 9–13	0.4	–	–	0.4	–	–
M 14–18	10.6*	–	–	0.2	–	–
M 19–30	2.4	–	–	–	0.4	–
M 31–50	3.8	–	–	2.0	0.6	–
M 51–70	3.2	–	–	7.2	0.4	–
M 71+	2.4	–	–	8.0	1.0	–
F 2–3	–	–	–	0.2	–	2.5
F 4–8	–	–	–	–	0.2	3.7
F 9–13	–	–	0.2	0.8	12.0*	0.2
F 14–18	1.4	–	–	0.6	0.6	1.6
F 19–30	0.8	0.4	–	0.6	0.6	2.6
F 31–50	1.8	0.2	–	1.4	1.2	4.7
F 51–70	0.4	0.4	0.8	3.4	0.6	–
F 71+	1.2	–	0.8	4.2	0.8	–

–, Value of 0.0%.
* Departures from the 10% threshold were tolerated because additional modeling suggested that the threshold is within the range of uncertainty for the observed proportion.
† The full probability method was used in the assessment of iron content.

than juice to maintain the dietary fiber content of the food intake pattern.

- "Make at least half of your grain products whole grain each day": Whole grains were needed for the achievement of adequate amounts of magnesium and fiber. In addition, a healthy diet rich in whole-grain products may reduce the risk of heart disease.
- "Drink skim, 1% or 2% milk each day": Lower-fat fluid milk was an effective way to obtain adequate calcium and vitamin D while remaining within an appropriate macronutrient profile and total amount of calories.
- "Include a small amount – 30 to 45 mL (2 to 3 Tbsp) – of unsaturated fat each day. This includes oil used for cooking, salad dressings, margarine, and mayonnaise": Foods in the unsaturated fat subgroup were included to achieve appropriate levels of essential fatty acids.

Statements were also included to guide food choices consistent with an appropriate macronutrient profile and conservative energy levels. In addition, guidance to choose foods lower in salt and sodium was included with the food intake pattern because the median sodium content of the food intake pattern for many age and gender groups exceeded the UL. Sodium is ubiquitous in the Canadian food supply. The following statements were

Table 7. Median Vitamin D Content of Simulated Diets Based on *Eating Well with Canada's Food Guide (2007)* Relative to the Adequate Intake (AI)

Age	AI	Males	Females
y	*μg*		
2–3	5.0	6.5	5.8
4–8	5.0	6.3	5.8
9–13	5.0	7.5	6.7
14–18	5.0	6.5	6.9
19–30	5.0	6.7	6.0
31–50	5.0	6.8	6.0
51–70	10.0	8.6	6.1
71+	15.0	11.3	6.1

included so that the total fat, saturated fat, and calorie content of the pattern remained appropriate, and to encourage food choices lower in salt:

- "Choose vegetables and fruit prepared with little or no added fat, sugar or salt."
- "Choose grain products that are lower in fat, sugar or salt."
- "Select lower fat milk alternatives."
- "Select lean meat and alternatives prepared with little or no added fat or salt."
- "Have meat alternatives such as beans, lentils and tofu often."

The review of evidence on foods and risk of chronic disease supported the overall food intake pattern developed. In addition, convincing evidence of the relationship between the consumption of fish, particularly fatty fish, and reduced risk of cardiovascular disease led to the inclusion of the statement: "Eat at least two Food Guide Servings of fish each week."

Specific Guidance on Vitamin D for People Over 50 Years of Age

The major sources of vitamin D in the Canadian food supply are foods to which vitamin D is added. All cows' milk and margarine are fortified with vitamin D. Because it is a commonly consumed food, fluid milk is a major dietary source of vitamin D in Canada. For this reason, for all ages it is recommended to "Have 500 mL (2 cups) of milk every day for adequate vitamin D."

Table 8. Median Sodium Content of Simulated Diets Based on *Eating Well with Canada's Food Guide (2007)* Relative to the Tolerable Upper Intake Level (UL)

Age	UL	Males	Females
y	*mg*		
2–3	1500	1496	1475
4–8	1900	1694	1659
9–13	2200	2560	2321
14–18	2300	3285	2667
19–30	2300	2962	2697
31–50	2300	3019	2334
51–70	2300	3054	2458
71+	2300	3046	2607

Table 9. Median Saturated Fat Content of Simulated Diets Based on *Eating Well with Canada's Food Guide (2007)

Age	Males	Females
y	*% of energy*	
2–3	9.2	9.0
4–8	8.2	8.2
9–13	7.9	7.4
14–18	7.0	7.3
19–30	6.0	5.8
31–50	6.7	6.7
51–70	7.3	6.4
71+	7.2	6.8

* Benchmark for all age groups is < 10% of energy.

The results in Table 7 show that the median vitamin D content of the food intake pattern for people over the age of 50 was below the AI. Trying to increase the vitamin D content of the food intake pattern through food sources alone was deemed impractical because it required unrealistic daily amounts of specific foods. For example, four to six cups of fluid milk would be required to satisfy vitamin D requirements in people over the age of 50.

Thus, it was recommended that in addition to following the Food Guide, all adults over the age of 50 should take a daily vitamin D supplement of 10 μg (400 IU). With this additional amount of vitamin D, the median vitamin D content of the food intake pattern for people over the age of 50 was at or exceeded the AI for this nutrient.

CONCLUSION

While there are other dietary patterns that are consistent with health, this food intake pattern was developed in the Canadian context and promotes a pattern of eating that meets nutrient needs, promotes health, and reduces the risk of nutrition-related chronic disease. The food intake pattern includes advice on the quantity of food that is age and gender specific, as well as guidance on the quality of food choices.

This innovative, evidence-based approach builds on assessment methods recommended in the DRI reports. The strength of this approach is the ability to assess the prevalence of nutrient inadequacy if the food intake pattern is followed. Any person following the food intake pattern has a high probability of meeting their nutrient requirements and a low probability of nutrient excess. The food intake pattern developed through this method achieves satisfactory results across the nutrients assessed and is consistent with evidence linking diet to reduced risk of chronic disease development.

Table 10. Summary of Energy Content of Simulated Diets (Calories) Based on *Eating Well with Canada's Food Guide (2007)*			
Gender/ Age (y)	**Sedentary Reference EER***	**P50**	**P10–P90**
M 2–3	1050–1200	1087	915–1291
M 4–8	1250–1500	1209	1051–1402
M 9–13	1550–2050	1882	1637–2154
M 14–18	2250–2500	2335	2079–2622
M 19–30	2450–2550	2344	2100–2605
M 31–50	2250–2450	2151	1933–2406
M 51–70	2050–2250	2179	1885–2501
M 71+	1850–2050	2152	1878–2453
F 2–3	1050–1100	1099	899–1323
F 4–8	1100–1350	1221	1058–1429
F 9–13	1400–1700	1726	1475–2041
F 14–18	1700–1800	1899	1660–2206
F 19–30	1850–1950	1830	1571–2106
F 31–50	1750–1900	1651	1439–1936
F 51–70	1600–1700	1796	1553–2071
F 71+	1450–1600	1779	1552–2009
*The range in the reference values reflects the range of ages within the groups (71+ includes 71–85 y). The reference EER values represent a range of medians of estimated energy requirements (i.e. the ranges do not represent lower bounds and upper bounds). EER, Estimated Energy Requirement; P, percentile.			

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