



Understanding the Science behind the Guiding Stars® Algorithm for Canada

The Guiding Stars® nutrition guidance program is based on national and international dietary recommendations and aligns with Canadian regulations as established by Health Canada (i.e. Canada's Food Guide) and implemented by the Canadian Food Inspection Agency (CFIA). The Guiding Stars® program evaluates the nutrient content of foods using nutrition data gleaned from the Nutrition Facts table and the ingredient list on product packaging. For products that do not have food labels such as fresh produce and meats, nutrition data is obtained from the Canadian Nutrient File (CNF) database. Moreover, CNF data is used for foods that contain only a single ingredient or a single ingredient plus water in order to generate consistent ratings for such products. Prior to evaluation, all foods are standardized to a 100 kilocalorie¹ (kcal) serving size. This standardization allows the consumer to compare products side by side and adjusts for serving size variation of the same product due to food packaging, as well as water weight. Four (4) separate algorithms are used to generate the Guiding Stars® ratings – 1) general foods and beverages, 2) meats/poultry/seafood/dairy/nuts, 3) fats and oils, and 4) infant and toddler foods. Note that items containing less than 5 kcal per manufacturer-specified serving size and hence not a significant source of nutrients (i.e., water, dried spices, coffee, tea) as well as alcohol, medical foods, natural health products and infant formula are not rated with the Guiding Stars® system.

To be consistent with Health Canada's food labeling policy, nutrients are only included in the Guiding Stars® algorithm if a significant scientific consensus regarding health promotion and/or an association with reduced risk of chronic disease has been documented, and when recommendations or authoritative statements have been established by a key scientific body. Although many nutrients and food constituents were considered, the rationale for exclusion from the Guiding Stars® program was a lack of consensus-based science, lack of a dietary recommendation, or feasibility issues. For example, the polyphenol content of foods is not possible to include as these data are not available for all edible products, nor are there established dietary intake recommendations. The Guiding Stars® algorithm includes as nutrients to encourage, vitamins and minerals, fibre, whole grains, omega-3 fatty acids, and as nutrients to limit, *trans* and saturated fatty acids, added sodium, and added sugars. Note that cholesterol is not included as a nutrient to limit in Canada (whereas it is in the U.S. version of Guiding Stars). A pivotal 1990 Canadian report entitled "Nutrition recommendations: the report of the scientific review committee" (cited to this day) did not specify an upper limit for dietary cholesterol and that has not changed. As such, Canada does not enforce a dietary recommendation for cholesterol and the presence of the %Daily Value (DV) in the Nutrition Facts table is optional. Thus an algorithm that includes debits for cholesterol would be inconsistent among food products and would not align with Canadian regulations.

Minimum and maximum threshold values were established for each nutrient included in the Guiding Stars® algorithm based on nutrient ratio to the 100 kcal energy referent, i.e., equivalent to 5% of energy intake based on a 2000 kcal diet. Nutrients listed on the Nutrition Facts table are presented as percentage of DV and are based on a fixed average energy intake value of 2000 kcal. Thus, if a 100 kcal serving of a food provides 5% of total energy intake (based on 2000 kcal), then following Health Canada's recommendation to balance nutrients with calories, one serving should also contain at least 5% of the DV for nutrients to encourage, and no more than 5% of the DV for those to limit. For five of the eight nutrients included in the system with established DVs (*trans* and saturated fat, sodium, vitamins/minerals, and fibre), threshold values using a base and multiples of 5% DV were assigned based on the model type (**Tables 1 and 2**). The thresholds for the remaining four nutrients without DVs were derived using established dietary guidance from authoritative scientific bodies (**Tables 1 and 2**). Specifically, omega-3 fatty acids cutoff values were assigned in accordance with the Institute of Medicine's upper Adequate Intake level for alpha-linolenic acid (ALA). For whole grains, the threshold for a bonus point was created in accordance with recommendations from Health Canada. For EPA+DHA, the threshold for a bonus point was created based on a growing global consensus for minimum recommended intake. Finally, cutoff values for added sugars were calculated based on the ideal of no added sugars, ≤10% of calories (based on World Health Organization recommendations), and ≤25% of calories (based on the Institute of Medicine recommendations). In order to not penalize foods which naturally contain sugars or sodium (such as milk and spinach, respectively), debit for added sugars and added sodium content is triggered by the presence of specific

¹ Note that kilocalories are expressed as calories on the Nutrition Facts table.

added sugars (i.e., sucrose, corn syrup, honey, molasses, etc.) and sodium (i.e. salt, sodium chloride) keywords identified in the ingredient statement. The added sugars keywords are consistent with those listed by the Canadian Food Inspection Agency but include additional sugars that have been found in the food supply. Additionally, all foods and beverages which exceed 600 mg sodium/100 kcal and all general foods and beverages that contained over 40% of calories from added sugars are automatically disqualified from earning a star rating regardless of the presence of positive nutrients. Likewise whole grains are identified by the presence of specific keywords (i.e., whole wheat, whole oats, brown rice, etc.) listed in the ingredients in combination with at least 1.5 g fiber per 100 kcal serving size.

The Guiding Stars® program is a point based system. The program awards credit points to products for nutrients to encourage and assigns debit points for nutrients to limit. The net score of a product is then translated into a Guiding Stars® rating of 0, 1, 2, or 3 (see below). Only foods with a score above 0, indicating that the positive nutrient contribution outweighs the negative nutrient contribution, receive a star rating. For example, a food containing a moderate amount of sodium could still earn stars as long as the positive points from the vitamins and minerals, omega-3 fatty acid and/or fibre content outweigh the sodium debit.

A manuscript which includes the U.S. Guiding Stars® algorithm for general foods and beverages, as well as meats, poultry, seafood, dairy, and nuts has been published in the November/December 2011 issue of the American Journal of Health Promotion.² The most current version of these algorithm tables for the Canadian version are also given below in **Tables 1** and **2**. Please note that while the patented Guiding Stars® concept and approach is firm, the algorithm details are subject to flux as new science emerges and dietary guidelines/recommendations are refined. The Guiding Stars® Scientific Advisory Panel reviews the algorithm on a regular basis and makes changes as needed.

Table 1. Algorithm for General Foods and Beverages:

Nutrients to Limit	POINTS ^a				
	0	-1	-2	-3	-11
Trans and Saturated Fat^b	≤1 g (5 % of DV)	≤2 g (10 % of DV)	≤3 g (15 % of DV)	>3 g (15 % of DV)	
Added sugars^c	None Added	≤10% kcal	≤25% kcal	≤40% kcal	>40% kcal
Added sodium^c	≤120 mg (5% DV)	≤240 mg (10% DV)	≤360 mg (15% DV)	≤600 mg (25% DV)	>600 mg
Nutrients to Encourage	POINTS ^a				
	+3	+2	+1	0	
Dietary fibre	≥3.75 g (15% DV)	≥2.5 g (10% DV)	≥1.25 g (5% DV)	<1.25 g (<5% DV)	
Vitamins & Minerals	≥10% DV of 2 or more vitamins/minerals	≥10% DV of 1 OR ≥5% DV of 2 or more vitamins/minerals	≥5% DV of 1 vitamin/mineral	<5 DV% of 1 vitamin/mineral	
Omega-3 Fatty Acids	≥0.81 g (30% AI)	≥0.54 g (20% AI)	≥0.27 g (10% AI)	< 0.27 g	
Whole grain^c	---	---	≥1.5 g fibre	---	
EPA & DHA	---	---	≥12.5 mg EPA or DHA, or EPA+DHA	---	

^aHighest possible score is 11. Score must exceed 0 points for product to receive stars. All general foods and beverages that exceed a sodium level of 600 mg or an added sugars content of 40% of total calories automatically receive no stars.

3 stars: 5-11 points

2 stars: 3-4 points

1 star: 1-2 points

0 stars: ≤ 0 points

^b*Trans* fat content is evaluated using an either/or two-step approach. If an amount of *trans* fat greater than zero is listed on the food label, then that value is evaluated; however, if 0 g or no amount is listed, then the ingredient list is scanned for the key words “partially hydrogenated” and subsequently scored. Any food with “partially hydrogenated” in the ingredients OR any food with “hydrogenated” in the ingredients statement AND a *trans* fat content ≥ 0.2 g receives a 1 point debit. (Please note that the maximum debit is 1 point even if both conditions are met.) The Guiding Stars® algorithm requires a 0 g value and no indication of partially hydrogenated ingredients in order to avoid a debit to the product scoring.

^cA two-step process of keyword recognition from the ingredients list and evaluation of nutrient value from the Nutrition Facts table is required.

Abbreviations: g (grams); DV (Daily Value); mg (milligrams); kcal (kilocalories); EPA (eicosapentaenoic acid); DHA (docosahexaenoic acid).

Meats/Seafood/Dairy and Nuts: As noted above, Guiding Stars® recognizes that there are different types of foods with inherently different nutrient profiles. Meats and seafood have intrinsically higher levels of certain nutrients such as saturated fat and cholesterol, and do not contain fibre and whole grains. Nuts likewise naturally contain higher levels of saturated fat, but do contain naturally occurring fibre. Canada’s Food Guide currently categorizes nuts with meat items. The model presented below was created to account for higher levels of saturated fats and lack of naturally occurring fibre (with the exception of nuts) or whole grain within these food categories, and to generate star ratings that align with and underscore current dietary recommendations.

Table 2. Algorithm for Meats, Poultry, Seafood, Dairy, and Nuts:

Nutrients to Limit	POINTS ^a				
	0	-1	-2	-3	-11
Trans and Saturated fat^b	≤ 1.5 g (7.5 % of DV)	≤ 2 g (10 % of DV)	≤ 2.5 g (12.5 % of DV)	> 2.5 g (12.5 % of DV)	
Added sugars^c	None Added	$\leq 10\%$ kcal	$\leq 25\%$ kcal	$> 25\%$ kcal	
Added sodium^c	≤ 120 mg (5% DV)	≤ 240 mg (10% DV)	≤ 360 mg (15% DV)	≤ 600 mg (25% DV)	> 600 mg
Nutrients to Encourage	POINTS ^a				
	+3	+2	+1	0	
Dietary fibre	NA	NA	≥ 1.25 g (5% DV)	< 1.25 g (<5% DV)	
Vitamins & Minerals	$\geq 10\%$ DV of 2 or more OR $\geq 20\%$ DV of 1 vitamins/minerals	$\geq 10\%$ DV of 1 OR $\geq 5\%$ DV of 2 or more vitamins/minerals	$\geq 5\%$ DV of 1 vitamin/mineral	< 5 DV% of 1 vitamin/mineral	
Omega-3 Fatty Acids	≥ 0.81 g (30% AI)	≥ 0.54 g (20% AI)	≥ 0.27 g (10% AI)	< 0.27 g	
EPA & DHA	---	---	≥ 12.5 mg EPA or DHA, or EPA+DHA	---	

^aHighest possible score is 8. Score must exceed 0 points for product to receive stars. All products that exceed a sodium level of 600 mg automatically receive no stars.

3 stars: 3-8 points

2 stars: 2 points

1 star: 1 point

0 stars: ≤ 0 points

^b*Trans* fat content is evaluated using an either/or two-step approach. If an amount of *trans* fat greater than zero is listed on the food label, then that value is evaluated; however, if 0 g or no amount is listed, then the ingredient list is scanned for the key words “partially hydrogenated” and subsequently scored. Any food with “partially hydrogenated” in the ingredients OR

any food with “hydrogenated” in the ingredients statement AND a *trans* fat content ≥ 0.2 g receives a 1 point debit. (Please note that the maximum debit is 1 point even if both conditions are met.) The Guiding Stars® algorithm requires a 0 g value and no indication of partially hydrogenated ingredients in order to avoid a debit to the product scoring.

^cA two-step process of keyword recognition from the ingredients list and evaluation of nutrient value from the Nutrition Facts table is required.

Abbreviations: g (grams); DV (Daily Value); mg (milligrams); kcal (kilocalories); EPA (eicosapentaenoic acid); DHA (docosahexaenoic acid).

Fats and Oils: A separate fats and oils model was created because the other algorithms do not include nutrients such as monounsaturated fatty acids that must be considered to differentiate fats and oils in a meaningful way. Most of the Guiding Stars® ratings for fats and oils are based on data obtained from the Canadian Nutrient File database as these nutrients are not consistently listed on the Nutrition Facts table.

Table 3. Algorithm for Fats and Oils:

Nutrients to Limit	POINTS ^a				
	0	-1	-2	-3	-11
Trans and Saturated fat^b	≤ 1.7 g (15 % of total energy)	≤ 3.4 g (30 % of total energy)	≤ 5.1 g (45 % of total energy)	> 5.1 g	
Added sugars^c	None Added	$\leq 10\%$ kcal	$\leq 25\%$ kcal	$> 25\%$ kcal	$> 40\%$
Added sodium^c	≤ 120 mg (5% DV)	≤ 240 mg (10% DV)	≤ 360 mg (15% DV)	≤ 600 mg (25% DV)	> 600 mg
Nutrients to Encourage	POINTS ^a				
	+3	+2	+1	0	
Total Omega-3 Fatty Acids	≥ 0.81 g (30% AI)	≥ 0.54 g (20% AI)	≥ 0.27 g (10% AI)	< 0.27 g	
MUFA	≥ 6.7 g (60% of fat kcal)	≥ 5.6 g (50% of fat kcal)	≥ 4.4 g (40% of fat kcal)	< 4.4 g	
EPA & DHA	---	---	≥ 12.5 mg EPA or DHA, or EPA+DHA	---	

^aHighest possible score is 6. Score must exceed 0 points for product to receive stars. All products that exceed a sodium level of 600 mg or an added sugars content of 40% of total calories automatically receive no stars.

3 stars: 3-6 points

2 stars: 2 points

1 star: 1 point

0 stars: ≤ 0 points

^b*Trans* fat content is evaluated using an either/or two-step approach. If an amount of *trans* fat greater than zero is listed on the food label, then that value is evaluated; however, if 0 g or no amount is listed, then the ingredient list is scanned for the key words “partially hydrogenated” and subsequently scored. Any food with “partially hydrogenated” in the ingredients OR any food with “hydrogenated” in the ingredients statement AND a *trans* fat content ≥ 0.2 g receives a 1 point debit. (Please note that the maximum debit is 1 point even if both conditions are met.) The Guiding Stars® algorithm requires a 0 g value and no indication of partially hydrogenated ingredients in order to avoid a debit to the product scoring.

^cA two-step process of keyword recognition from the ingredients list and evaluation of nutrient value from the Nutrition Facts table is required.

Abbreviations: g (grams); DV (Daily Value); mg (milligrams); kcal (kilocalories); MUFA (monounsaturated fatty acid); EPA (eicosapentaenoic acid); DHA (docosahexaenoic acid).

Infant and Toddler Foods: A separate algorithm was created to evaluate infant and toddler foods to reflect the unique nutritional needs of this age group. This algorithm is consistent with the others in that it uses a 100-kcal standardization. However, it references a 1000 kcal diet as its base as per the American Academy of Pediatrics' recommendations for toddlers. Many elements included in the other algorithms are not reiterated in this model as there is not an emphasis on increasing or restricting these nutrients (i.e. fibre, *trans* fat) until individuals are over 2 years old. Baby formula is not rated by the Guiding Stars® program.

Table 4. Algorithm for Infant and Toddler Foods:

Nutrients to Limit	POINTS ^a			
	0	-1	-2	-3
Added sugars^b	None Added	≤10% kcal	≤25% kcal	>25% kcal
Added sodium^b	≤100 mg (10% AI)	≤200 mg (20% AI)	≤300 mg (30% AI)	>300 mg (>30% AI)
Nutrients to Encourage	POINTS ^a			
	+3	+2	+1	0
Vitamins & Minerals	≥20% DV of 1 OR ≥10% DV of 2 or more vitamins/minerals	≥10% DV of 1 OR ≥5% DV of 2 or more vitamins/minerals	≥5% DV of 1 vitamin/mineral	<5 DV% of 1 vitamin/mineral

^aHighest possible score is 3. Score must exceed 0 points for product to receive stars.

3 stars: 3 points

2 stars: 2 points

1 star: 1 point

0 stars: ≤ 0 points

^bA two-step process of keyword recognition from the ingredients list and evaluation of nutrient value from the Nutrition Facts table is required.

Abbreviations: kcal (kilocalories); mg (milligrams); AI (Adequate Intake); DV (Daily Value).

Summary:

This document is intended to provide a detailed overview into understanding the science behind the Guiding Stars algorithm for Canada. It is not intended to cover every detail associated with the patented Guiding Stars program. Please contact the Guiding Stars management team through the contact form on our website <http://guidingstars.ca/contact/>, or by sending an email to Info@GuidingStars.com with any additional questions or concerns. Thank you for your interest in Guiding Stars.

²Fischer LM, Sutherland LA, Kaley LA, Fox TA, Hasler CM, Nobel J, Kantor MA, Blumberg J. Development and implementation of the Guiding Stars nutrition guidance program. Am J Health Promot. 2011 Nov;26(2):e55-63.