Understanding the Science Behind Guiding Stars®

The Guiding Stars® nutrition guidance program is based on national and international dietary recommendations and aligns with the most current Dietary Guidelines for Americans (DGA). The Guiding Stars program evaluates the nutrient content of foods and beverages using nutrition data gleaned from the Nutrition Facts label 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 United States Department of Agriculture (USDA) National Nutrient database. Moreover, USDA data is used for foods that contain only a single ingredient or a single ingredient plus water to generate consistent ratings for such products.

Prior to evaluation, all foods are standardized to a 100 kilocalorie (kcal) or 12 ounce (for beverages) 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.

Five (5) separate algorithms are used to generate the Guiding Stars ratings: (1) General Foods, (2) Meats, Poultry, Seafood, Dairy & Nuts, (3) Fats & Oils, (4) Infant & Toddler Foods, and (5) Beverages.

To be consistent with the DGA and U.S. Food & Drug Administration (FDA) labeling policy, dietary components are only included in the Guiding Stars algorithms if a significant scientific consensus regarding health promotion and/or an association with reduced risk of chronic disease or untoward health effects has been documented, and when recommendations or statements have been established by an authoritative scientific body. Although many dietary components 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 algorithms include vitamins and minerals, fiber, whole grains, omega-3 fatty acids, monounsaturated fatty acids (MUFA; for fats and oils only), and live active cultures (beverages only) as dietary components to encourage. The Guiding Stars algorithms include dietary components to limit: *trans* fatty acids, saturated fatty acids, added sodium, added sugars, artificial colors, and other additives to limit (beverages only).

For algorithms 1-4, minimum and maximum threshold values were established for each dietary component included in the Guiding Stars algorithms. They are based on nutrient ratio to the 100-kcal energy reference, that is, equivalent to 5% of energy intake based on a 2,000-kcal diet. Dietary components listed on the Nutrition Facts label are presented as percentage of Daily Values (DV) and are based on a fixed average energy intake value of 2,000 kcal. Thus, if a 100-kcal serving of a food provides 5% of total energy intake (based on 2,000 kcal), then following the DGA recommendation to balance nutrients with calories, one serving should

also contain at least 5% of the DV for dietary components to encourage, and no more than 5% of the DV for dietary components to limit.

For those dietary components included in the algorithms with established DVs (saturated fat, cholesterol, sodium, vitamins/minerals, and fiber), threshold values using a base and multiples of 5% DV were assigned based on the model type (Tables 1 and 2) except for cholesterol, which uses a simple upper limit kick-out rule.

The thresholds for the remaining dietary components without DVs were derived using established dietary guidance from authoritative scientific bodies. Cutoff values for added sugars were calculated based on the ideal of no added sugars, ≤10% of calories (based on 2015 Dietary Guidelines and World Health Organization recommendations), and ≤25% of calories (based on recommendations of the National Academy of Medicine (NAM), formerly the Institute of Medicine).

To not penalize foods which naturally contain sugars or sodium (such as milk and spinach, respectively), debit for added sugars and added sodium content are triggered by the presence of specific added sugars (i.e., corn syrup) and sodium (i.e. salt) keywords identified in the ingredients statement. The added sugars keywords are consistent with those listed in the USDA "Added Sugars" database and include additional sugars that have been found in the food supply. Additionally, all foods which exceed 575 mg sodium/100 kcal, 300 mg cholesterol/100 kcal, or contain over 40% of calories from added sugars are disqualified from earning a star rating regardless of the presence of positive dietary components. As a specific DRI has not been established for omega-3 fatty acids, the thresholds used for this dietary component are based on NAM's Adequate Intake level for alpha linolenic acid (ALA).

When Guiding Stars first launched, beverages were evaluated with the General Foods algorithm. However, as this model standardized serving sizes to 100 kcal, very low and no calorie beverages such as water and flavored seltzers could not be evaluated. As beverages are the leading contributor of added sugars in the diet and can exert both positive and negative health impacts, we felt a separate beverage algorithm able to rate all types of drinks was warranted.

For the Beverage Algorithm, all products are first standardized to a serving size of 12 oz, or the FDA Reference Amount Customarily Consumed (RACC) for most beverages including water, coffee, tea, and carbonated beverages. Given that the RACC serving size is used, when possible, threshold values for the included dietary components and ingredients were likewise based on FDA guidelines and definitions which reference that same unit. For example, the first cut point for sodium (<140 mg) is equivalent to the FDA low sodium claim. Likewise, the first cut point for saturated fat is equivalent to the value for the FDA low saturated fat claim (<1 g). The added sugars debit is expressed in teaspoons (4 g) of sugar to align with guidance from the DGA recommending that added sugars be limited to 12 tsp per day.

The Beverage Algorithm also includes the addition of one dietary component to encourage—live active cultures—to recognize fermented drinks such as kombuchas and water kefirs. The

algorithm also incorporates two additional dietary components to limit, total sugar content to address juices with high natural sugar content, as well as additives to limit which include artificial colors and flavors, non-nutritive sweeteners, and chemical preservatives. Beverages which contain >12 g (3 tsp) of added sugars, >485 mg of added sodium, or ≥2 additives to limit are disqualified from earning a star rating. The nutritional objectives of this algorithm are to identify high quality beverages that provide hydration without an excess of calories or unnecessary ingredients.

The Guiding Stars program is point-based. The program awards credit points to products for dietary components to encourage and assigns debit points for dietary components to limit. The net score of a product is then translated into a Guiding Stars rating of 0, 1, 2, or 3. Only foods with a score >0, indicating that the positive dietary component contribution outweighs the negative, receive stars. For example, a food containing 220 mg sodium per 100 kcal, which is within the mid-range of assigned values, could earn stars if the positive points from the vitamin/mineral, fiber, and/or omega 3 fatty acid content exceed the points debited for sodium.

When Guiding Stars was created and launched in 2006, dietary cholesterol was included as a dietary component to limit, and specific threshold amounts were assigned for each debit point value (0 to -3 points). However, since the 2015 DGA eliminated the quantitative limit for dietary cholesterol, the original debits in the Guiding Stars algorithms were removed. It now contains an upper limit kick-out debit rule so that any foods with excessive amounts of dietary cholesterol (>300mg/100 kcal) are disqualified from earning a star rating, regardless of the presence of dietary components to encourage.

In 2018, the FDA announced the revision of recommended DVs along with the update of the Nutrition Facts label with a compliance date of January 2020. In anticipation of this change, and to accommodate manufacturers that have already taken steps to update their labels, the Guiding Stars Scientific Advisory Panel (SAP) revised the algorithms to align with the updated Nutrition Facts label and DV changes. Moreover, the SAP decided to give credit more broadly for foods with beneficial omega-3 fatty acids (including eicosapentaenoic acid (EPA) and/or docosahexaenoic acid (DHA)), and to penalize foods that contain artificial colors.

The original version of the Guiding Stars algorithm for Fats & Oils only included credit for total omega-3 fatty acids and a bonus point for long-chain EPA and/or DHA. However, in the 2018 update, these dietary components were added to the algorithm for General Foods as well as the algorithm for Meats, Poultry, Seafood, Dairy & Nuts. This decision was made due to accumulating scientific evidence demonstrating the anti-inflammatory and disease preventing effects of omega-3 fatty acids. Beginning in 2018, artificial colors have been added to the algorithms as a penalty. Foods containing any number of artificial colors are debited by one star rating. Such additives have been shown to exacerbate negative behaviors such as hyperactivity and inattentiveness in some children, and there is growing pressure to remove these from the food supply. In Europe, most foods containing synthetic food dyes are required to display a warning label, and great strides have been made to

replace artificial colors in foods (especially those targeted towards children) with naturally derived food dyes (e.g., beet root extract).

A manuscript which includes the Guiding Stars algorithms for General Foods, as well as Meats, Poultry, Seafood, Dairy & Nuts has been published.[1] The most current version of these algorithm tables, in addition to the algorithms for Fats & Oils and Baby & Toddler Foods are provided below in Tables 1 through 5. Please note that while the patented Guiding Stars concept and approach is firm, algorithm details are subject to revision as new science emerges, and dietary guidelines/recommendations are updated. The SAP reviews the algorithms on a regular basis and recommends changes as needed.

This document is intended to provide a detailed overview into understanding the science behind the Guiding Stars algorithms. 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, guidingstars.com/contact-us, or by sending an email to Info@GuidingStars.com with any additional questions or concerns. Thank you for your interest in Guiding Stars.

[1]Fischer 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 Promotion 2011 Nov; 26(2):e55-63.

General Foods

Table 1. Algorithm for General Foods:

Dietary components to limit	POINTS[a]				
	0	**-1**	**-2**	**-3**	**-11**
Trans fat[b]	<0.5 g (not listed in ingredients)	<0.5 g (listed in ingredients)	≤1 g	>1 g	
Saturated fat	≤1 g (5% DV)	≤2 g (10% DV)	≤3 g (15% DV)	>3 g (>15% DV)	
Cholesterol	---	---	---	--	>300 mg
Added sugars[c]	None Added	≤10% kcal	≤25% kcal	≤40% kcal	>40% kcal
Added sodium[c]	≤115 mg (5% DV)	≤230 mg (10% DV)	≤345 mg (15% DV)	≤575 mg (25% DV)	>575 mg
Dietary components to encourage	**POINTS[a]**				
	+3	**+2**	**+1**	**0**	
Dietary fiber	≥4.2 g (15% DV)	≥2.8 g (10% DV)	≥1.4 g (5% DV)	<1.4 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	
Total Omega-3 fats	≥0.81 g (30% AI)	≥0.54 g (20% AI)	≥0.27 g (10% AI)	<0.27 g	

> Bonus Point Value
> - (+1) Whole Grain*
> - (+1) >12.5 mg EPA or DHA, or EPA+DHA
> Penalty Point Value
> - (-2) for artificial colors listed in the ingredients list

ᵃ Highest possible score is 11 (if product receives bonus points). Score must exceed 0 points for product to receive stars. All general foods that exceed a sodium level of 575 mg, a cholesterol level of 300 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 >0 is listed on the food label, then that value is evaluated; however, if 0 g or no amount is listed, then the ingredients list is scanned for the key words "partially hydrogenated" and subsequently scored. The Guiding Stars algorithm requires a 0 g value and no indication of partially hydrogenated ingredients to avoid a debit to the product scoring.

ᶜ A two-step process of keyword recognition from the ingredients list and evaluation of nutrient value from the Nutrition Facts label is required.

Abbreviations: g (grams); DV (Daily Value); mg (milligrams); kcal (kilocalories).

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Meats, Poultry, Seafood, Dairy & Nuts

Guiding Stars recognizes there are different types of foods with inherently different nutrient profiles. Meats and seafood have intrinsically higher levels of certain dietary components such as saturated fat, and do not contain fiber and whole grains. Similarly, nuts naturally contain higher levels of saturated fat but do contain naturally occurring fiber. The FDA, along with other major health organizations, specifies different standards of saturated fat for meats and seafood in their definition of `healthy.' The DGA categorizes nuts with meat items. The model presented below was created to account for higher levels of endogenous saturated fats and lack of naturally occurring fiber (except for nuts) or whole grains within these food categories, and to generate star ratings that align with and underscore current DGA recommendations.

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

Dietary components to limit	POINTS[a]				
	0	-1	-2	-3	-11
Trans fat[b]	<0.5 g (not listed in ingredients)	<0.5 g (listed in ingredients)	≤1 g	>1 g	
Saturated fat	≤1.5 g (7.5% DV)	≤2 g (10% DV)	≤2.5 g (12.5% DV)	>2.5 g (>12.5% DV)	
Cholesterol	---	---	--	--	>300 mg
Added sugars[c]	None Added	≤10% kcal	≤25% kcal	>25% kcal	
Added sodium[c]	≤115 mg (5% DV)	≤230 mg (10% DV)	≤345 mg (15% DV)	≤575 mg (25% DV)	>575 mg
Dietary components to encourage	POINTS[a]				
	+3	+2	+1	0	
Dietary fiber	NA	NA	≥1.4 g (5% DV)	<1.4 g (<5% DV)	
Vitamins & Minerals	≥10% DV of 2 or more OR ≥20% DV of 1 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	

Total Omega-3 fats	≥0.81 g (30% AI)	≥0.54 g (20% AI)	≥0.27 g (10% AI)	<0.27 g	

➢ Bonus Point Value
   o (+1) >12.5 mg EPA or DHA, or EPA+DHA
➢ Penalty Point Value
   o (-1) for artificial colors listed in the ingredients list

[a] Highest possible score is 8. Score must exceed 0 points for product to receive stars. All products that exceed a cholesterol level of 300 mg or a sodium level of 575 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 ingredients list is scanned for the key words "partially hydrogenated" and subsequently scored. The Guiding Stars algorithm requires a 0 g value and no indication of partially hydrogenated ingredients to avoid a debit to the product scoring.

[c] A two-step process of keyword recognition from the ingredients list and evaluation of nutrient value from the Nutrition Facts label is required.

Abbreviations: g (grams); DV (Daily Value); mg (milligrams); kcal (kilocalories).

Fats & Oils

A separate algorithm for fats and oils was created because the other algorithms did not originally include dietary components such as omega-3 fatty acids (which include alpha-linolenic acid, EPA, DHA, and MUFA) 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 USDA National Nutrient database as these dietary components are not consistently listed on the Nutrition Facts label.

Table 3. Algorithm for Fats & Oils:

Dietary components to limit	POINTS[a]				
	0	**-1**	**-2**	**-3**	**-11**
Trans fat[b]	Not listed in ingredients	≤0.5 g	≤1 g	>1 g	
Saturated fat	≤2.2 g (7% of total energy)	≤2.7 g (8.5% of total energy)	≤3.2 g (10% of total energy)	>3.2g	
Cholesterol	---	---	---	---	>300 mg
Added sugars[c]	None Added	≤10% kcal	≤25% kcal	>25% kcal	>40%
Added sodium[c]	≤115 mg (5% DV)	≤230 mg (10% DV)	≤345 mg (15% DV)	≤575 mg (25% DV)	>575 mg
Dietary components to encourage	POINTS[a]				
	+3	**+2**	**+1**	**0**	
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	

➢ Bonus Point Value
   ○ (+1) >12.5 mg EPA or DHA, or EPA+DHA
➢ Penalty Point Value
   ○ (-1) for artificial colors listed in the ingredients list

a Highest possible score is 6 (as a fat or oil cannot be completely high in both omega-3 fatty acids and MUFA). Score must exceed 0 points for product to receive stars. All products that exceed a cholesterol level of 300 mg, a sodium level of 575 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 debit only applies to added *trans* fat and will not penalize naturally occurring *trans* fats (i.e. conjugated linoleic acid) in keeping with FDA labeling regulations. Thus, *trans* fat acid content is only evaluated if the words "partially hydrogenated" appear in the ingredients list. If the words "partially hydrogenated" appear in the ingredients list on the product label, then the amount of *trans* fat given in the ESHA/USDA database or on the label is evaluated and scored per the thresholds given in the algorithm table. If the words "partially hydrogenated" appear in the ingredients statement, but the *trans* fat content in either the ESHA/USDA database or the Nutrition Facts label is < 0.5 g (including 0 g), or is not provided, the product receives -1 point for this element. If the words "partially hydrogenated" do not appear in the ingredients list on the product label, the product is not debited for *trans* fat even if an amount of *trans* fat is given in the ESHA/USDA database or on the label.

c A 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 & 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 per the American Academy of Pediatrics' recommendations for toddlers. Emphasis is placed on vitamins and minerals recommended by the American Academy of Pediatrics, and which are central to federal nutrition programs such as the Special Supplemental Nutrition Program for Women, Infants, and Children. Moreover, many elements included in the other algorithms are not reiterated in this model as there is not an emphasis on increasing or restricting these dietary components (i.e., fiber, *trans* fat) until individuals are >2 years old. Baby formula is not evaluated by the Guiding Stars program. This algorithm applies to products with an Infant or Child Nutrition Facts label and/or products labeled to be consumed by children 2 years of age or less.

Table 4. Algorithm for Infant & Toddler Foods:

Dietary components 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)
Dietary components 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

➤ Penalty Point Value
  o (-1) for artificial colors listed in the ingredients list

[a] Highest 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

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

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

Beverages

Beverages are defined as products which provide hydration, are in liquid form, are intended to be consumed in their sold-as state and are not intended to replace a meal or be used for medicinal purposes. Beverages not evaluated by this algorithm include alcoholic beverages, concentrates such as liquid flavor drops or products designed to be diluted with water, dairy milk (including flavored varieties), milk-based drinks (e.g., smoothies and kefir), nut-based milks, and drink mixes.

All items are initially assigned 3 points and then receive credits and/or debits. After calculating the initial product score, items that receive no debits whatsoever, contain no additives to limit, no added sodium, and no sweeteners of any kind earn an additional bonus of 3 points.

Table 5. Algorithm for Beverages:

Dietary components to limit	POINTS[a]				
	0	-1	-2	-3	-11
Added sugars[b]	None Added	≤4 g	≤8 g	≤12 g	>12 g
Natural sugars	<15 g	≥15 g	≥20 g	≥25 g	
Additives to limit[c]	None Added	Contains 1			Contains ≥2
Saturated fat	≤1 g	≤3 g	≤5 g	>5 g	
Added sodium[b]	≤140 mg	≤255 mg	≤370 mg	≤485 mg	>485 mg
Dietary components to encourage	POINTS[a]				
	+3	+2	+1	0	
Dietary fiber			≥1.0 g		
Vitamins & Minerals			≥10% DV of 1 OR ≥5% DV of 2 or more vitamins/ minerals		

Live active cultures[d]			Present	Absent	

[a] Score must exceed 0 points for product to receive stars. Highest possible score is 9 (if product receives all credits and bonus points). All beverages that exceed a sodium level of 485 mg, an added sugars content of 12 g, or contain ≥ 2 additives to limit are ineligible to receive stars.

3 stars: ≥ 6 points
2 stars: 3-5 points
1 star: 1-2 points
0 stars: ≤ 0 points

[b] A two-step process of keyword recognition from the ingredients list and evaluation of dietary component value from the Nutrition Facts label is required.

[c] Additives to limit include all artificial colors and flavors, non-nutritive sweeteners, and chemical preservatives. Research and survey of FDA, WHO, and FAO databases were used to develop the extensive list of additives to limit used in this algorithm.

[d] Live active cultures are identified by the presence of bacteria or culture names listed in the Ingredients list.

Abbreviations: g (grams); DV (Daily Value); mg (milligrams); kcal (kilocalories)