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 2015 Dietary Guidelines for Americans (DGA). The Guiding Stars® program evaluates the nutrient content of foods 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 in order to generate consistent ratings for such products. Prior to evaluation, all foods are standardized to a 100 kilocalorie (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.

To be consistent with the DGA and Food and Drug Administration (FDA) 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, fiber, whole grains, omega-3 fatty acids (for fats and oils only), and monounsaturated fatty acids (MUFA; for fats and oils only), and as nutrients to limit, *trans* fatty acids, saturated fatty acids, added sodium, and added sugars.

When Guiding Stars was created and launched in 2006, dietary cholesterol was included as a nutrient to limit in the algorithm 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 algorithm were removed accordingly. Instead, the algorithm now contains an upper limit kick-out debit rule so that any foods with excessive amounts of dietary cholesterol (>300mg/100 cal) are disqualified from earning a star rating, regardless of the presence of nutrients to encourage.

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 label are presented as percentage of Daily Values (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 the DGA 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 (saturated fat, 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 three nutrients 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 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 added sugars (i.e. corn syrup) and sodium (i.e. salt) keywords identified in the ingredient statement. The added sugars keywords are consistent with those listed in the USDA Added Sugars database but include additional sugars that have been found in the food supply. Additionally, all foods and beverages which exceed 600 mg sodium/100 kcal, all foods which exceed 300 mg cholesterol/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.

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. Only foods with a score above 0, indicating that the positive nutrient contribution outweighs the negative nutrient contribution, receive stars. For example, a food containing 240 mg sodium per100 kcal, which is within the mid-range of assigned values, could earn stars as long as the positive points from the vitamin/mineral and/or fiber content outweigh the sodium debit.

A manuscript which includes the Guiding Stars® algorithm for general foods and beverages, as well as meats, poultry, seafood, dairy, and 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 **4**. 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**	**-10**
Trans fat‡	<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*	None Added	≤10% kcal	≤25% kcal	≤40% kcal	>40% kcal
Added sodium*	≤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 fiber	≥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	
Whole grain*	---	---	≥1.5 g fiber	---	

[a]Highest possible score is 7 (if product receives bonus point). Score must exceed 0 points for product to receive stars. All general foods and beverages that exceed a sodium level of 600 mg, a cholesterol level of 300 mg, or an added sugars content of 40% of total calories automatically receive no stars.
3 stars: 5-7 points
2 stars: 3-4 points
1 star: 1-2 points
0 stars: ≤ 0 points
‡ *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. 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.

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

<u>Abbreviations</u>: g (grams); DV (Daily Value); mg (milligrams); kcal (kilocalories).

Meats/Seafood/Dairy and Nuts: 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 do not contain fiber and whole grains. Nuts likewise 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 (with the exception of nuts) or whole grain 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, and Nuts:

Nutrients to Limit	POINTS(a)				
	0	**-1**	**-2**	**-3**	**-10**
Trans fat‡	<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*	None Added	≤10% kcal	≤25% kcal	≤40% kcal	
Added sodium*	≤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 fiber	NA	NA	≥1.25 g (5% DV)	<1.25 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	

[a]Highest possible score is 4. 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 600 mg automatically receive no stars.
3 stars: 3-4 points
2 stars: 2 points
1 star: 1 point
0 stars: ≤ 0 points

‡ *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. 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.

*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 and Oils: A separate fats and oils model was created because the other algorithms do not include nutrients such as omega-3 fatty acids (which include alpha-linolenic acid, eicosapentaenoic acid [EPA] and docosahexaenoic acid [DHA]) and monounsaturated fatty acids (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 nutrients are not consistently listed on the Nutrition Facts label.

Table 3. Algorithm for Fats and Oils:

Nutrients to Limit	POINTS[a]				
	0	**-1**	**-2**	**-3**	**-10**
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]	≤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**	
Omega-3 Fatty Acids	≥1.14 g	≥0.76 g	≥0.38 g	< 0.38 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	---	---	Contains any amount of both EPA and DHA	---	

[a]Highest possible score is 5 (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 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 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 statement 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

statement 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 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. Emphasis is placed on vitamins and minerals recommended by the American Academy of Pediatrics', and central to federal feeding programs such as WIC. 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 nutrients (i.e. fiber, *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

[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.

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. 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.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 Promot. 2011 Nov;26(2):e55-63.