Nutrient Scoring Calculation Methodology

A Method for Simple Comparison

Abstract

Nutrient density is considered a gold standard in measuring a food's nutritional value. Nutrient density is the measure of the amount of nutrients in a food product in proportion to its energy content, weight or other measures [1]. This paper defines a methodology for comparing the nutrient density of different foods based on essential nutrients, total sugar, potassium/sodium ratio, and Omega-6/ Omega-3 ratio.

Keywords: Nutrient Density, Nutrient Score

1. Methodology explained

The methodology of this Nutrient Score is based on Daily Recommended Intake (DRIs) values required to meet a human's daily essential nutrient needs [2]. This Nutrient Score has been scaled to the FDAs Daily Value (DVs) of 2,000 calories [3].

The standard reference chosen is set against the DRI of a male (age 19-30) weighing 180 lbs. These recommendations were chosen as they meet the needs of most Americans [4].

1.1 Nutrient Score

A food's Nutrient Score is measured on a 100g portion and consists of 44 scoring measures. Since this Nutrient Score is standardized against the FDA's Daily Value of 2,000 calories, each nutrient scoring measure is worth a potential total of 45.45 points:

2,000 calories / 44 scoring measures = 45.45

Unless otherwise noted in the details below, the Nutrient Score of each scoring measure represents the proportion of the nutrient included relative to its daily DRI. For example, the DRI of Vitamin B2 is 1.2mg. If a single 100g portion of a food contained 0.6mg of Vitamin B2, it would capture 50% of the total 45.45 points available or 22.75.

Sodium and total sugar have the potential to score positive or negative points.

Nutrient Score points are scored as follows:

- 0 - 45.45 points are available for each of 39 essential nutrients (ENs)
    - 14 vitamins
    - 14 minerals
    - 9 amino acids
    - 2 fatty acids (Omega-3, Omega-6)
- 0 - 90.90 points are available for Fiber
- 0 - 45.45 points are available for each of the following EN ratios:
    - Potassium / Sodium
    - Omega-6 / Omega-3
- 0 - 45.45 points are available based on the amount of total sugar

2. Vitamins, Minerals, Amino Acids, Fatty Acids

Description

There are 40 essential nutrients with DRIs across five nutrient categories; vitamins, minerals, amino acids, fatty acids, and fiber. Below a table details which nutrients comprise each of these five categories.

2.1 Essential Nutrients

Vitamins	Minerals	Amino Acids	Fatty Acids
• Vitamin A • Vitamin B1 • Vitamin B2 • Vitamin B3 • Vitamin B5 • Vitamin B6 • Vitamin B7 • Vitamin B9 • Vitamin B12 • Vitamin C • Vitamin D • Vitamin E • Vitamin K • Choline	• Calcium • Chromium • Copper • Iodine • Iron • Magnesium • Manganese • Molybdenum • Phosphorus • Potassium • Selenium • Zinc • Chloride • Sodium	• Histidine • Isoleucine • Leucine • Lysine • Methionine + (Cysteine SAA) • Phenylalanine + (Tyrosine) • Threonine • Tryptophan • Valine	• Omega-3 • Omega-6 **Fiber** • Fiber

Formula

For the 40 essential nutrients above, the points for the Nutrient Score component is derived by dividing the weight of the essential nutrient in a 100g portion by the Dietary Reference Intake and multiplying the result by the points possible:

(weight per 100g portion / DRI) * 45.45.

See Vitamin B2 example in section 1.1 above.

3. Fiber

Description

Fiber is allowed a total of 90.90 points. In this methodology, fiber is valued for supporting human and microbiome function [5,6].

Formula

(weight per 100g portion / DRI) * 45.45 * 2.

4. Essential Nutrient Ratios

Description

There are two EN ratios included in this Nutrient Score methodology.

4.1 Potassium / Sodium (K/Na)

The ideal ratio of K/Na is derived from DRI(K)/DRI(Na) or 3,400mg/1,500mg [7].

Formula

If the ratio in the food is >= 3,400/1,500, then full points. Otherwise no points.

The ratio is included in this Nutrient Score methodology because evidence indicates significant health benefits from a combined reduction in sodium and increase in potassium compared to changes in sodium and potassium separately [8].

4.2 Omega 6 / Omega 3

The ideal ratio of Omega 6/3 is derived from DRI(Omega 6)/DRI(Omega 3) or 17/1.6.

Formula

- If the ratio in the food is <=17/1.6, then full points. Otherwise no points
- If BOTH omega 6 and 3 are 0, then 0 points
- If omega 3 is 0, then 0 points

5. Total Sugar

Description

This Nutrient Scoring methodology awards points to foods low in total sugar and subtracts points from foods with high amounts of total sugar. Excess sugar consumption is associated with numerous negative health consequences [9].

Formula

- If > 20g, then -10 * 45.45
- If > 15g, then -5 * 45.45
- If > 10g, then -1 * 45.45
- If > 5g, then 0.5 * 45.45
- If > 0g and <=5g, then 45.45 points are awarded
- If 0g, then 45.45 points are awarded

6. Sodium

Description

While sodium is an essential nutrient, the typical Western diet contains too much [10]. As a result, if excessive amounts of sodium are present in a food it will have a negative impact on a food's Nutrient Score.

Formula

The DRI for sodium is 1,500 mg / day. A food's sodium component score is calculated as follows:

- If <= 100mg, then 0 * 45.45
- If > 100 and <= 200mg, then 0.5 * 45.45
- If > 200 and <= 400mg, then 1 * 45.45
- If > 400 and <= 600mg, then 0.5 * 45.45
- If > 600 and <= 800mg, then 0 * 45.45
- If > 800 and <= 1000mg, then -2 * 45.45
- If > 1,000mg, then -5 * 45.45

7. Summary

This Nutrient Scoring methodology is a measure of nutrient density that can be used to compare nutrition across all foods and drinks.

APPENDIX

Daily Recommended Intake (DRIs)

Vitamins

Vitamin	Available Nutrient Score Points	DRI	Unit
Vitamin A	0 - 45.45	900	ug RAE
Vitamin B1 (thiamin)	0 - 45.45	.12	mg
Vitamin B2 (riboflavin)	0 - 45.45	1.3	mg NE
Vitamin B3(niacin)	0 - 45.45	1.6	mg
Vitamin B5 (pantothenic acid)	0 - 45.45	5	mg
Vitamin B6 (pyridoxine)	0 - 45.45	1.3	mg
Vitamin B7 (biotin)	0 - 45.45	30	ug
Vitamin B9 (folic acid, folate/total)	0 - 45.45	400	ug DFE
Vitamin B12 (cobalamin)	0 - 45.45	2.4	ug
Vitamin C (ascorbic acid)	0 - 45.45	90	mg
Vitamin D (vitamin D2 or Ergocalciferol and vitamin D3 or Cholecalciferol	0 - 45.45	15	IU
Vitamin E (tocopherol)	0 - 45.45	15	mg
Vitamin K (phylloquinone)	0 - 45.45	120	ug
Choline (vitamin Bp)	0 - 45.45	550	mg
Total Available Vitamin Nutrient Score Points	**636.30**		

Minerals

Mineral	Available Nutrient Score Points	DRI	Unit
Calcium	0 - 45.45	1000	mg
Chromium	0 - 45.45	35	ug
Copper	0 - 45.45	900	ug
Iodine	0 - 45.45	150	ug
Iron	0 - 45.45	8	mg
Magnesium	0 - 45.45	400	mg
Manganese	0 - 45.45	2.3	mg
Molybdenum	0 - 45.45	45	mcg
Phosphorus	0 - 45.45	700	mg
Potassium	0 - 45.45	3400	mg
Selenium	0 - 45.45	55	ug
Zinc	0 - 45.45	11	mg
Chloride	0 - 45.45	2.3	g
Total Available Mineral Nutrient Score Points	**590.85**		

Amino Acids

Amino Acid	Available Nutrient Score Points	DRI	Unit
Histidine	0 - 45.45	1120	mg
Isoleucine	0 - 45.45	1520	mg
Leucine	0 - 45.45	3360	mg
Lysine	0 - 45.45	3040	mg
Methionine + (Cysteine SAA)	0 - 45.45	1520	mg
Phenylalanine + (Tyrosine)	0 - 45.45	2640	mg
Threonine	0 - 45.45	1600	mg
Tryptophan	0 - 45.45	400	mg
Valine	0 - 45.45	320	mg
Total Available Amino Acid Nutrient Score Points	**590.85**		

Fatty Acids

Fatty Acid	Available Nutrient Score Points	DRI	Unit
Omega 3 (Alpha-linolenic acid (ALA))	0 - 45.45	1.6	g
Omega-6 (Linoleic acid (LA))	0 - 45.45	17	g
Total Available Fatty Acid Nutrient Score Points	**90.90**		

Essential Ratios

Essential Ratio	Available Nutrient Score Points	DRI	Unit
Potassium / Sodium (K/Na)	0 or 45.45	3,400 / 1,500	g
Omega 6 / Omega 3	0 or 45.45	17 / 1.6	g
Total Available Fatty Acid Nutrient Score Points	**90.90**		

Fiber

Fiber	Available Nutrient Score Points	DRI	Unit
Total Fiber	0 - 90.90	38	g
Total Available Fiber Nutrient Score Points	**90.90**		

Sodium and Sugar

Essential Ratio	Available Nutrient Score Points	DRI	Unit
Total Sodium	-227.25 - 45.45	1500	mg
Total Sugar	-454.50 - 45.45	<50	g
Total Available Sodium and Sugar Nutrient Score Points	**90.90**		

References

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