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## Starbucks Menu Health Analysis

### Contents

1. Overview
2. Goal
3. Methodology
  - a. Debating Weight Values
  - b. Sample Calculation
4. Results
  - a. Overall
  - b. By Beverage Category
5. Appendix
  - a. Each Menu Item Ranked
6. Sources

### Overview

This study takes all 106 Starbucks beverages, and aims to mathematically determine to what extent each item is healthy or unhealthy. The process involves converting nutrient info values into its %Daily Value (DV), assigning a positive or negative value to each nutrient, then aggregating a total percent. A total score that is positive indicates a beverage is more healthy than unhealthy, and vice versa. At the end, each item is ranked from healthiest to unhealthiest.

### Goal

The main goal is to make judgments on what Starbucks menu items should be avoided, and which are not so bad for individual health, based on simple criteria. Some insights about the menu as a whole will also be provided. Hopefully, the results presented here can be useful in making better dietary decisions.

### Methodology

Before calculations can be done, each nutrient is assigned a positive/negative value, then weighted. Some nutrients have more severe consequences than others, so they should score lower towards the overall health rating. Data is provided courtesy of Kaggle (see Sources). Only nutrition info provided in the data set will be accounted for, so for example, Potassium, Vitamin B, and E, etc. are excluded.

A summary of each nutrient, and brief rationales for each nutrient, are provided below. More in-depth explanations are linked with respective sources, generally the FDA and NIH.

Nutrient	100% DV <sup>1</sup>	UL	Classification	Weighted
Total Fat	78g		Neutral	0x
Saturated Fat	20g	20g	Negative	1x
Trans Fat	2g*	2g	Negative	1.25x
Cholesterol	300mg	300mg	Negative	1x
Sodium	2300mg	2300mg	Negative	1x
Total Carbohydrate	275g		Neutral	0x
Dietary Fiber	28g	70g	Positive	1x
Total Sugars			Neutral	0x
Added Sugars	50g	50g	Negative	1x
Protein	50g	125g	Positive	1x
Vitamin A	900mcg	3000mcg	Positive	0.75x
Vitamin C	90mg	2000mg	Positive	1x
Vitamin D	20mcg	1000mcg	Positive	1x
Calcium	1300mg	2500mg	Positive	0.75x
Iron	18mg	45mg	Positive	1x
Caffeine			Neutral	0x

\*Currently, no 100% DV for Trans Fat is established. Some sources state that 2 grams is the limit one can consume safely.

The Upper Limit (UL) is factored in as well, which represents the amount of consumption leading to toxicity. Overconsumption can lead to adverse effects, even in “Positive” nutrients.

## Positives

- Dietary Fiber: Speeds up movement of food and waste in the digestive system (easier bowel movements), and lowers cholesterol levels in the bloodstream<sup>2</sup>. Overconsumption results in mild consequences such as constipation and bloating<sup>3</sup>.
- Protein: Builds and repairs cells and body tissue. Important for blood clotting, immune response, and proper growth<sup>4</sup>. Toxicity can lead to kidney stones<sup>5</sup>.
- Vitamin A: Supports cell growth, and heart and overall organ maintenance. Toxicity can result in birth defects, blurred vision, and liver damage. Such irreversible effects contribute to a 0.75x weighted value<sup>6</sup>.
- Vitamin C: Promotes metabolism, wound healing, and cancer and disease prevention. Overconsumption leads to mild effects such as cramping, nausea, and diarrhea<sup>7</sup>.
- Vitamin D: Supports bone growth, calcium absorption, and immune function. Has some serious consequences when reaching toxicity, such as kidney and heart damage, but this is offset by a very high UL to reach such levels<sup>8</sup>.
- Calcium: preventing osteoporosis, promoting bone health, and reducing fractures. Bypassing the UL may cause hypercalcemia and kidney malfunction<sup>9</sup>. Relatively severe effects and fairly low UL contribute to a 0.75x score instead of 1.0x.
- Iron: Necessary for neurological development, cell functioning, and reduced risk of anemia. Toxicity can lead to nausea, vomiting, and faintness<sup>10</sup>.

## Negatives

- Only Trans fat is weighted at -1.25x, while the rest remain at -1.0x. This is because it can be argued that even small amounts of Sugar, Sodium, and Cholesterol are necessary to good health. The same cannot be said for Trans Fat, which is even banned in some countries. It increases risk of heart disease, diabetes, and dementia. It should be avoided at all costs<sup>11</sup>.

## Neutrals

- Lastly, Calories, Total Fat, and Total Carbohydrates are valued at 0x. These nutrients highly vary in recommended intake depending on lifestyle, diet, biological sex, pregnancy status, physical activity, etc.

## Debating Weight Values

It is fairly reasonable to debate the current Weight values. One can envision a much more nuanced weighting system with more precise values. In particular, Saturated Fat and Cholesterol could be weighted more negatively, but not as much as Trans Fat.

However, deciding “by how much” can make crucial differences (e.g. -1.10x or -1.05x?) and comes down to opinion. Such input requires expert nutritionists which is outside the scope of this study. Otherwise introducing too many weighted values can heavily bias overall health ratings. This is why weighting was evaluated on relatively simple criteria and kept to a minimum.

### Sample Calculation

To give a clearer picture on how this works, take menu item #72: Shaken Iced Tazo Tea (With Classic Syrup). It has: 60 Calories, 15g Carbohydrate, 15g Sugar, 6% DV of Iron, and 170mg Caffeine

Calories, Carbs, and Caffeine are weighted at 0x, so only Sugar and Iron remain. 15g of Sugar equates to 30% DV, so aggregating the weight values gives:

$0x \text{ Calories} + 0x \text{ Carbohydrates} + (-1.0) * 30\% \text{ Sugar} + (1.0) * 6\% \text{ Iron} = -30\% + 6\% = -24\%$  total health score. This negative value implies Shaken Iced Tazo Tea cannot be recommended as part of a healthy diet due to high sugar content and no other nutritional value.

### Results

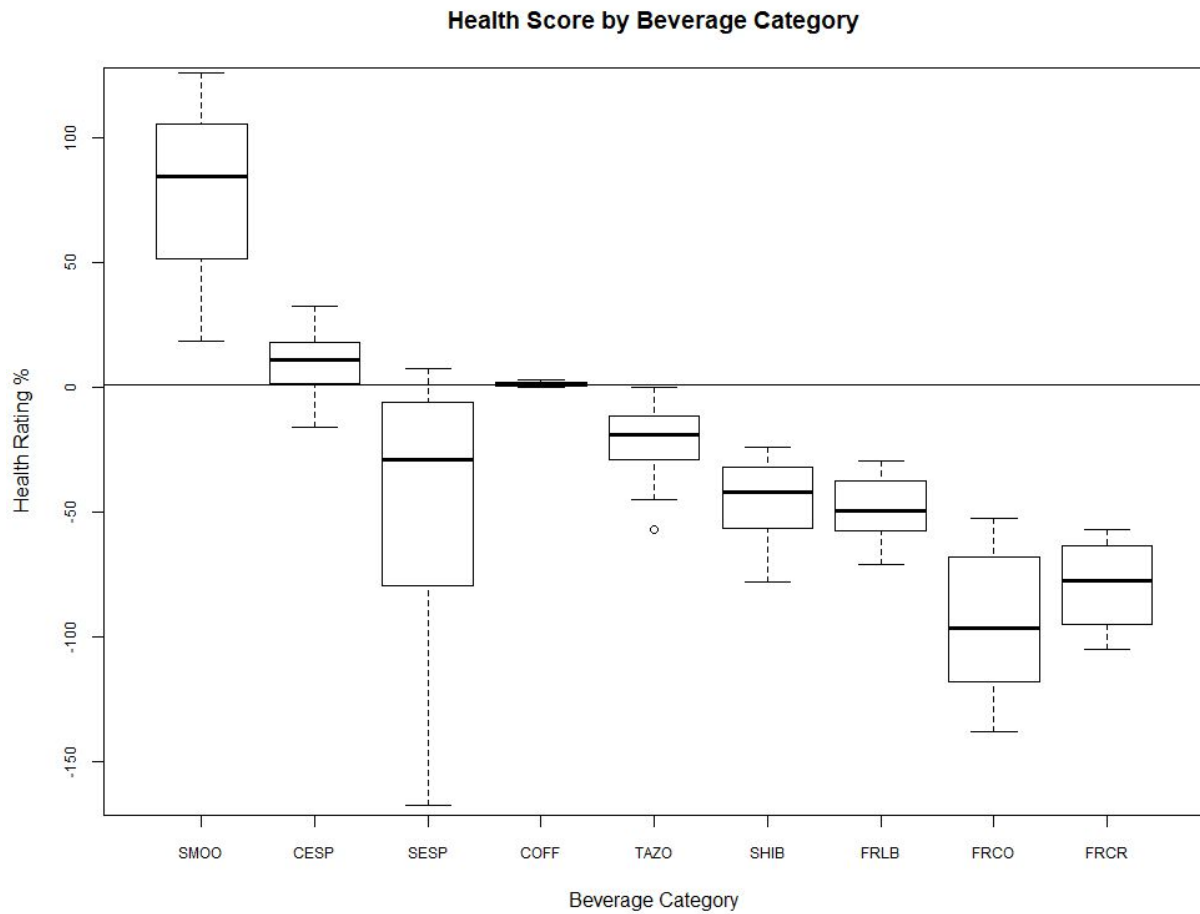
#### Overall

After coding the above process in R and running it on all 106 menu items, results show the average health score across all items is -30.08% and the median is -23.86. This means, overall, Starbucks drinks do not contribute to a healthy diet. 34 of 106 (32%) drinks had a positive score, while 72 of 106 (68%) of Starbucks drinks had a negative score.

Mean Health Score	-30.08%	
Drinks with Positive Score ( $\geq 0$ )	34 of 106 (32%)	May be beneficial in diet
Drinks with Negative Score ( $<0$ )	72 of 106 (68%)	Cannot recommend in diet

It is important to note that even top ranked beverages were fairly high in sugar content. In fact, the most common culprit to a low score is Sugar, where 62 of 106 items contain >50% DV of Sugar in just one serving.

## By Beverage Category



Abbreviation	Category Names	# of Beverages	Health Score Avg.	Sugar %DV Average
SMOO	Smoothies	3	76.58%	74.67%
CESP	Classic Espresso Drinks	25	9.76%	32.64%
SESP	Signature Espresso Drinks	16	-47.55%	87.38%
COFF	Coffee	4	1.39%	0.00%
TAZO	Tazo Tea Drinks	20	-20.07%	56.10%
SHIB	Shaken Iced Beverages	12	-44.94%	53.00%
FRLB	Frappuccino Light Blended Coffee	9	-48.31%	69.11%
FRCO	Frappuccino Blended Coffee	12	-94.50%	116.00%
FRCR	Frappuccino Blended Creme	5	-79.49%	100.80%

The category results are highly polarizing. They are almost either all positive or all negative, with few exceptions.

3 of 9 categories average positively. Smoothies make the top of the list, because they contain fruit which provide essential vitamins. They are high in sugar, averaging 74.67% of the DV intake, but these can be due to natural occurring sugars. Classic Espresso Drinks and Coffee have the lowest sugar values, contributing to decent scores.

6 of 9 are negative, due to high sugar content but no nutritional value to balance these drinks out positively.

Due to the polarizing nature of these statistics, it may not be a stretch to prescribe avoiding any and all drinks from certain categories. For example, all 3 Frappuccino categories are negative, while most Coffees are fairly safe and offer simple caffeine.

## Appendix

### Each Menu Item Ranked

Beverage.Name	Health Score	Ranking
Orange Mango Banana Smoothie Grande	126.04%	1
Strawberry Banana Smoothie Grande	84.90%	2
Caffe Latte Venti	32.91%	3
Skinny Latte (Any Flavour) Venti	31.22%	4
Caffe Latte Grande	25.81%	5
Skinny Latte (Any Flavour) Grande	23.63%	6
Cappuccino Venti	21.62%	7
Cappuccino Grande	19.92%	8
Banana Chocolate Smoothie Grande	18.81%	9
Skinny Latte (Any Flavour) Tall	18.15%	10
Caffe Latte Tall	17.87%	11
Caffe Mocha (Without Whipped Cream) Grande	16.79%	12
Caffe Mocha (Without Whipped Cream) Venti	15.35%	13
Cappuccino Tall	13.29%	14
Skinny Latte (Any Flavour) Short	12.86%	15
Caffe Latte Short	11.07%	16
Caffe Mocha (Without Whipped Cream) Tall	8.56%	17
Cappuccino Short	8.47%	18
Hot Chocolate (Without Whipped Cream) Grande	7.89%	19

Hot Chocolate (Without Whipped Cream) Tall	3.87%	20
Brewed Coffee Venti	3.07%	21
Caffe Americano Tall	3.07%	22
Caffe Americano Grande	2.85%	23
Caffe Americano Venti	2.85%	24
Brewed Coffee Grande	1.57%	25
Caffe Mocha (Without Whipped Cream) Short	1.55%	26
Espresso Solo	0.80%	27
Caffe Americano Short	0.58%	28
Brewed Coffee Tall	0.57%	29
Brewed Coffee Short	0.38%	30
Tazo Tea Short	0.00%	31
Tazo Tea Tall	0.00%	32
Tazo Tea Grande	0.00%	33
Tazo Tea Venti	0.00%	34
Hot Chocolate (Without Whipped Cream) Venti	-1.77%	35
Hot Chocolate (Without Whipped Cream) Short	-5.64%	36
Caramel Macchiato Short	-6.46%	37
Vanilla Latte (Or Other Flavoured Latte) Short	-6.71%	38
Vanilla Latte (Or Other Flavoured Latte) Tall	-9.20%	39
Tazo Green Tea Latte Tall	-9.28%	40
Caramel Macchiato Tall	-10.73%	41
Tazo Green Tea Latte Short	-13.36%	42
Vanilla Latte (Or Other Flavoured Latte) Grande	-13.50%	43
Tazo Full-Leaf Tea Latte Short	-14.46%	44
Tazo Full-Leaf Red Tea Latte (Vanilla Rooibos) Short	-14.46%	45
Caramel Macchiato Grande	-14.74%	46
Vanilla Latte (Or Other Flavoured Latte) Venti	-15.91%	47

Tazo Full-Leaf Tea Latte Tall	-18.49%	48
Tazo Full-Leaf Red Tea Latte (Vanilla Rooibos) Tall	-18.49%	49
Tazo Green Tea Latte Venti	-18.89%	50
Tazo Green Tea Latte Grande	-20.22%	51
Caramel Macchiato Venti	-22.97%	52
Tazo Full-Leaf Tea Latte Grande	-23.86%	53
Tazo Full-Leaf Red Tea Latte (Vanilla Rooibos) Grande	-23.86%	54
Shaken Iced Tazo Tea (With Classic Syrup) Tall	-24.00%	55
Tazo Chai Tea Latte Short	-24.67%	56
Iced Brewed Coffee (With Milk & Classic Syrup) Tall	-27.09%	57
Java Chip Tall	-29.32%	58
Iced Brewed Coffee (With Classic Syrup) Tall	-29.77%	59
Mocha Tall	-29.95%	60
Tazo Chai Tea Latte Tall	-33.14%	61
Tazo Full-Leaf Tea Latte Venti	-33.20%	62
Tazo Full-Leaf Red Tea Latte (Vanilla Rooibos) Venti	-33.20%	63
Iced Brewed Coffee (With Milk & Classic Syrup) Grande	-34.30%	64
White Chocolate Mocha (Without Whipped Cream) Short	-34.63%	65
Caramel Tall	-37.09%	66
Shaken Iced Tazo Tea Lemonade (With Classic Syrup) Tall	-37.80%	67
Mocha Grande	-39.62%	68
Iced Brewed Coffee (With Classic Syrup) Grande	-41.62%	69
Shaken Iced Tazo Tea (With Classic Syrup) Grande	-42.00%	70
Tazo Chai Tea Latte Grande	-44.73%	71
Java Chip Grande	-49.29%	72
Iced Brewed Coffee (With Milk &	-50.67%	73



Classic Syrup) Venti		
Shaken Iced Tazo Tea Lemonade (With Classic Syrup) Grande	-50.80%	74
Coffee Tall	-52.46%	75
White Chocolate Mocha (Without Whipped Cream) Tall	-53.93%	76
Caramel Grande	-55.20%	77
Strawberries & Creme (Without Whipped Cream) Tall	-56.59%	78
Tazo Chai Tea Latte Venti	-57.04%	79
Mocha Venti	-57.52%	80
Mocha (Without Whipped Cream) Tall	-60.45%	81
Iced Brewed Coffee (With Classic Syrup) Venti	-61.42%	82
Shaken Iced Tazo Tea (With Classic Syrup) Venti	-62.00%	83
Java Chip (Without Whipped Cream) Tall	-63.32%	84
Vanilla Bean (Without Whipped Cream) Tall	-63.46%	85
Java Chip Venti	-66.19%	86
Caramel Apple Spice (Without Whipped Cream) Short	-66.43%	87
White Chocolate Mocha (Without Whipped Cream) Grande	-69.52%	88
Caramel Venti	-70.66%	89
Caramel (Without Whipped Cream) Tall	-72.46%	90
Strawberries & Creme (Without Whipped Cream) Grande	-77.51%	91
Shaken Iced Tazo Tea Lemonade (With Classic Syrup) Venti	-77.80%	92
Coffee Grande	-85.63%	93
White Chocolate Mocha (Without Whipped Cream) Venti	-89.06%	94
Vanilla Bean (Without Whipped Cream) Grande	-94.92%	95
Java Chip (Without Whipped Cream) Grande	-95.73%	96

Mocha (Without Whipped Cream) Grande	-96.49%	97
Caramel Apple Spice (Without Whipped Cream) Tall	-98.65%	98
Strawberries & Creme (Without Whipped Cream) Venti	-104.97%	99
Caramel (Without Whipped Cream) Grande	-108.07%	100
Coffee Venti	-112.71%	101
Mocha (Without Whipped Cream) Venti	-122.89%	102
Java Chip (Without Whipped Cream) Venti	-125.81%	103
Caramel Apple Spice (Without Whipped Cream) Grande	-130.87%	104
Caramel (Without Whipped Cream) Venti	-138.03%	105
Caramel Apple Spice (Without Whipped Cream) Venti	-167.09%	106

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