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Abstract
Research during the last several decades indicates the failure of existing nutritional labels to substantially improve the healthfulness of consumers' food/beverage choices. The present study aims to fill this void by developing a nutrition metric that is more comprehensible to the average shopper. The healthfulness ratings of 205 sample foods/beverages by leading nutrition experts formed the basis for a linear regression that places weights on 12 nutritional components (ie, total fat, saturated fat, cholesterol, sodium, total carbohydrate, dietary fiber, sugars, protein, vitamin A, vitamin C, calcium, and iron) to predict the average healthfulness rating that experts would give to any food/beverage. Major benefits of the model include its basis in expert judgment, its straightforward application, the flexibility of transforming its output ratings to any linear scale, and its ease of interpretation. This metric serves the purpose of distilling expert knowledge into a form usable by consumers so that they are empowered to make more healthful decisions.

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A Nutrition Metric

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and Lisa Sutherland, Ph.D.

ABSTRACT

Background

Research over the last several decades indicates the failure of existing nutritional labels to substantially improve the healthiness of consumers' food and beverage choices. The difficulty for policy-makers is to encapsulate a wide body of scientific knowledge in a labeling scheme that is comprehensible to the average shopper. Here, we describe our method of developing a nutrition metric to fill this void.

Methods

We asked leading nutrition experts to rate the healthiness of 205 sample foods and beverages, and after verifying the similarity of their responses, we generated a model that calculates the expected average healthiness

rating that experts would give to any other product based on its nutrient content.

Results

The form of the model is a linear regression that places weights on 12 nutritional components (total fat, saturated fat, cholesterol, sodium, total carbohydrate, dietary fiber, sugars, protein, vitamin A, vitamin C, calcium, and iron) to predict the average healthiness rating that experts would give to any food or beverage. We provide sample predictions for other items in our database.

Conclusions

Major benefits of the model include its basis in expert judgment, its straightforward application, the flexibility of transforming its output ratings to any linear scale, and its ease of interpretation. This metric serves the purpose of distilling expert knowledge into a form usable by consumers so that they are empowered to make healthier decisions.

Although standards of living are generally improving in the U.S. and other developed countries, health problems attributable to poor nutrition persist, due in part to consumers' inability to translate the dietary advice of nutrition experts into behavioral change. Citing the improvement of public health as a primary objective, numerous studies have highlighted the need for a nutritional scoring system that is both comprehensive in its coverage of food products and easily understood by consumers[1-5]. We aim to advance this objective by proposing a nutrition metric that is based on the current views of leading experts in the field and can be used to score any food or beverage for which several component nutrient quantities are known.

Regulatory efforts to improve nutritional labeling, such as the 1990 Nutrition Labeling and Education Act (NLEA), have had relatively limited impact in altering the behavior of individuals who were not already motivated to eat more healthily[6,7]. The complexity of processing nutritional information serves to limit the influence of point-of-purchase labeling[8], especially in fast-food settings[9] or when many options are available[10]. It may be especially difficult for consumers to interpret a food's contribution to overall diet[11] and to take into consideration the presence of favorable nutrients, given consumers' established tendency to focus disproportionately on avoiding negative components[6,12-13]. Furthermore, the positive impact of more transparent labeling practices may be obscured by promotional efforts of manufacturers[1,14]. Not only can food advertising result in misleading generalization by consumers[15], but it may even exacerbate negative behavior such as overeating in the case of "low fat" claims[16].

Despite the limited success described above, there are several indications that nutritional labeling might have greater potential to assist consumers in making healthy

food choices. For instance, direct comparability of nutrient information across options has been shown to induce more advantageous product selections[13,17], and there is evidence suggesting that nutrition labeling schemes may be more effective when they are better adapted to a target audience or when they employ simple messages that promote taste as well as healthiness[18]. Given specific behavioral recommendations, subsequent decision-making is evaluated more favorably according to both consumers' own judgments and expert standards[19]. In addition, though marketers will likely continue attempts to promote the healthiness of their products regardless of true nutritional value, unbiased nutritional information may influence consumers' beliefs independently from these claims[20,21], and consumer misperceptions may be mitigated by greater transparency about the net value of foods' nutritional components[22].

Several recent studies have developed more detailed guidelines for accurate and effective nutritional labeling. Padberg[3] finds a large degree of consensus amongst experts regarding the relative nutritional value of various foods, and calls for an Expert Rating System that appropriately weights various nutrient factors to summarize any food's nutritional value as part of a daily diet. Advancing this goal, Nijman et al.[2] designed a Nutrition Score to characterize foods and beverages based on their levels of four detrimental components (trans fat, saturated fat, sugar, and sodium) whose generic benchmark levels have been established by scientific evidence. Unfortunately, their Final Product Nutrition Score fails to take into consideration the presence of favorable nutrients that also affect an item's healthiness. Perhaps the most thorough attempt at outlining desirable features of a nutritional profiling system is provided by Scarborough, Rayner, and Stockley[5], advocating "a systematic, transparent and logical process" to categorize

foods based on their nutritional composition. Scarborough, Boxer, Rayner, and Stockley[23] evaluated each of eight existing nutrient profile models based on the correlations of their ratings with healthiness categorizations of 120 foods by nutrition professionals. We agree with the implicit logic that expert assessments are in some sense the most comprehensive embodiment of current scientific knowledge on nutrition, but we go one step further than Scarborough et al. by actually employing expert ratings to generate our model.

Our basic methodology was to survey leading nutrition experts about the healthiness of sample foods and beverages, to estimate the regression equation that best predicts expert ratings of foods using each item on a Nutrition Facts label as a predictor, and finally to analyze the applicability of this model to rating the healthiness of products outside our initial sample. In light of the goals of nutritional labeling described in the literature, we believe this approach has multiple benefits. First, it does not require experts to explicitly assign valuations to different nutrients, a procedure that would be prone to imprecision if experts are not accustomed to making direct numerical tradeoffs between nutrients. However, it still captures experts' judgments about the healthiness of different foods. Second, our model's output ratings can be transformed to any continuous distribution or categorization that is deemed optimal for conveying information to consumers in a particular context. Third, our model makes clear quantitative predictions about how experts would rate the overall healthiness of any item as part of a daily diet and can thus be used to compare nutritional values of foods and beverages either across or within product categories.

METHODS

Food/Beverage Sample

A large online grocer provided us with a database containing nutritional information for over 15,000 unique food and beverage SKUs. Also listed in the database were the 205 categories used by the grocer to classify items and the unit sales of each item in 2005. In order to create a sample of foods representative of the items that consumers purchase most regularly but also covering a range of food/beverage types, we selected the most purchased item in each of the categories to comprise a sample of 205 foods and beverages for experts to rate. For each of these items, we collected any nutritional information that was missing from the grocer's database by searching for similar items on the USDA[24] and NutritionData[25] websites. In all cases, we were able to find very close matches in terms of product description and size.

Expert Sample

We requested participation from leading nutrition experts in rating the healthiness of the 205 sample foods/beverages described above. To mitigate bias in our responses, we contacted all 57 members of three groups that are widely recognized for their expertise in the study of nutrition: (1) Chairs of the top three schools of public health nutrition departments (Harvard University, Johns Hopkins University, and the University of North Carolina); (2) Directors of the eight U.S. Clinical Nutrition Research and

Human Nutrition Centers; and (3) Directors of the 46 Coordinated Programs in Dietetics with accredited status from the American Dietetic Association. These experts – all of whom have earned doctoral degrees in fields related to nutrition – were each offered $250 for their participation in our study, which required them to complete a one-hour online survey. The overall response rate was 23% (13 participants).

Data Collection

Our web-based survey asked that participants rate the healthiness of each of the 205 foods/beverages in our sample when they are consumed (or used as ingredients) in the recommended serving size. We displayed the item name provided by the online grocer in its database, a picture of the item found online, and a nutrition label that we generated to look like a typical Nutrition Facts label shown on the package (see Appendix A for a survey screenshot). The label listed serving size, servings per container, calories per serving, calories from fat per serving, and the amount per serving of the following 12 components:

- Total fat (amount in grams and % daily value)
- Saturated fat (amount in grams and % daily value)
- Cholesterol (amount in milligrams and % daily value)
- Sodium (amount in milligrams and % daily value)
- Total carbohydrate (amount in grams and % daily value)
- Dietary fiber (amount in grams and % daily value)
- Sugars (amount in grams)

- Protein (amount in grams)
- Vitamin A (% daily value)
- Vitamin C (% daily value)
- Calcium (% daily value)
- Iron (% daily value)

Participants rated each of the 205 items on an 11-point Likert scale from -5 ("very unhealthy") to 5 ("very healthy").

RESULTS

For each of the 13 experts surveyed, we ran an ordinary least squares (OLS) regression of the healthiness ratings they provided for the 205 sample foods/beverages on the 12 nutritional components of these items listed on a Nutrition Facts label (see Methods: Data Collection). Note that for components typically shown in both absolute amount and percentage of daily value on a Nutrition Facts label, we included only the absolute amount since the latter is redundant. For the same reason, we excluded from our set of predictor variables "calories per serving", which is equal to 9 * fat grams + 4 * carbohydrate grams + 4 * protein grams + 7 * alcohol grams (alcohol was absent from the foods and beverages in our sample), and also excluded "calories from fat," which is equal to 9 * fat grams. It did not substantively change the predictive power of the models to replace the amounts of all nutritional components with their percentages of daily

values or to include the predictor variables “calories per serving” and “calories from fat,” so we will not report the results of those models.

The 13 regression models resulting from our analyses of individual experts’ survey responses indicate the implicit weightings (positive or negative) that each expert placed on various nutritional components in assessing the healthiness of sample foods and account for a considerable amount of the variance in each expert’s sample ratings (average R-squared of 0.48; average adjusted R-squared of 0.45). We first used each expert’s linear model to predict his/her ratings for the sample foods/beverages and compared them to the actual ratings given. The average difference between an expert’s predicted rating and actual rating was 1.56 on the 11-point scale (which decreased slightly to 1.51 when we cut off predictions at the upper and lower endpoints of the ratings scale, which were -5 and 5, respectively). Next, we used each expert’s linear model to predict what his/her ratings would be for the remaining items in our database. Since the models were based on 12 label components shown on the Nutrition Facts label, we made predictions for just the subset of 9,393 items with these variables already available in our database.

To measure the similarity of the 13 experts’ models for healthiness, we calculated Cronbach’s alpha across the original sample ratings (0.95) and across the predictions for other items in the database (0.98). Cronbach’s alpha is a measure of inter-rater reliability, and values that approach 1 like those reported above suggest that raters have very similar “underlying representations” of the construct they are rating (in this case, healthiness). Coupled with the only moderately high R-squared values of the raters’ models, we can infer that the variation left unexplained by each rater’s model was not caused by a large

rating error but rather by the exclusion of predictors from the models that affect the healthiness of foods/beverages similarly for all experts. This indicates that the Nutrition Facts label may be missing some important unknown variables that experts agree affect the healthiness of foods and beverages. Despite this limitation on the variables available on for inclusion in our model, we argue that the high levels of correlation across experts' judgments justifies the generation of a single linear model to predict the *average* expert opinion about the healthiness of a given food/beverage.

To generate such a model, we first averaged the ratings given by the 13 experts for each sample food/beverage. Across the 205 sample items, the average rating for experts had a mean of 0.30 and a standard deviation of 2.2 on the -5 to 5 scale. Next, we ran a robust regression to predict this average rating using the 12 nutritional components on each grocery's Nutrition Facts label as right-hand side variables. We calculated robust standard errors to allow for the possibility of heteroskedasticity. The results of our regression model to predict expert average ratings for a food/beverage are shown in Table 1. To summarize, the best predictor for the average rating that experts would give to any other food/beverage based on its nutritional components (to three significant digits) is:

$$\begin{aligned}\text{Predicted rating} = {} & 0.710 - 0.0538*\mathit{fat} - 0.423*\mathit{satfat} - 0.00398*\mathit{chol} - 0.00254*\mathit{sod} \\ & - 0.0300*\mathit{carb} + 0.561*\mathit{fib} - 0.0245*\mathit{sug} + 0.123*\mathit{pro} + 0.00562*\mathit{vita} \\ & + 0.0137*\mathit{vitc} + 0.0685*\mathit{calc} - 0.0186*\mathit{iron}\end{aligned}$$

where the nutrient abbreviations correspond to the items listed in Table 1, in order, and units for all components must be specified as in Table 1. See Appendix B for example calculations of predicted ratings for two sample foods.

Using the model to predict ratings for all 205 foods/beverages in our sample, we found that the output predictions had an average absolute difference of 1.06 and a correlation of 0.791 with the actual average ratings used as inputs (which improved slightly to an average absolute difference of 1.03 and correlation of 0.805 when predictions were cut off at the endpoints of our 11-point scale). The model's R-squared of 0.626 suggests that it captures almost two-thirds of the variance in experts' average ratings of foods and beverages.

We next used the model to predict the average ratings that would be given by the population of experts to the other 9,393 foods/beverages in our database based on the 12 predictor variables on a Nutrition Facts label. Upon inspection, the predictions seemed very reasonable. The average predictions across items within each of the 205 product categories are shown in Appendix C, ordered from highest average rating to lowest average rating. To give some sense of the usefulness of comparison within a single category, the predictions for all items listed under "All Other Salty Snacks" are shown in Appendix D, ordered from highest predicted rating to lowest predicted rating.

Although the valence of impact that most nutrients have on the healthiness of a food may be common knowledge even to lay consumers, the clear contribution of our model is an assignment of a magnitude weighting to each nutritional component of a food/beverage. This allows the separate effects of each nutritional component to be isolated without compromising the ability to summarize their combined impact in a single

metric. Indeed, the model summarized in Table 1 demonstrates that some nutritional components have significant positive effects on a food's healthiness while others have significant negative effects, implying that previous models focusing solely on either positive or negative nutrients omitted critical information that experts take into account when rating a food's healthiness. While we have necessarily made some tradeoffs between the explanatory power of our model and its simplicity, we believe that our model includes the most important inputs to the healthiness judgments of nutrition experts as a result of its reliance on the nutrition inputs included on all Nutrition Facts labels.

DISCUSSION

By obtaining experts' ratings for a broad sample of foods and beverages, we have derived a comprehensive model for rating a food or beverage's healthiness that meets many of the desired criteria for such a metric. First and foremost, our method of sampling both experts and foods was deliberately transparent to eliminate as much bias as possible from our results. The decision to generate a model of a food's healthiness based on average expert ratings was validated by a high level of agreement across experts regarding the healthiness of sample items. In addition, our metric has a straightforward interpretation of providing the predicted average expert rating that a food or beverage would receive based on its Nutrition Facts label. Finally, the fact that our model's output ratings lie along a one-dimensional numerical spectrum allows for ease of interpretation,

suggesting these ratings could be understood by consumers making decisions about what foods and beverages to buy and consume.

We foresee several possible applications for our model. Similar to the work of Scarborough, Boxer, Rayner, and Stockley[23], the predicted ratings of our model (or the actual sample ratings for that matter) could be correlated with ratings produced by other, competing metrics to determine whether these other measures actually incorporate the knowledge of experts into their proposed nutrient weightings. More importantly, we hope that our model will be used to generate healthiness ratings for foods and beverages that could be displayed on or near product labels, allowing consumers to make more informed choices about what products to purchase and consume. To this end, we plan to conduct controlled experiments to test the extent to which the output of our model helps consumers to make decisions that are more closely aligned with the recommendations of nutrition experts.

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TABLES AND FIGURES

Table 1 – Regression results for average expert rating of 205 sample foods/beverages

	Coefficient
(Intercept)	0.710 *** (0.207)
Total fat (g)	-0.0538 (0.0414)
Saturated fat (g)	-0.423 *** (0.0944)
Cholesterol (mg)	-0.00398 (0.00330)
Sodium (mg)	-0.00254 *** (0.000445)
Total carbohydrate (g)	-0.0300 ** (0.0110)
Fiber (g)	0.561 *** (0.109)
Sugar (g)	-0.0245 (0.0190)
Protein (g)	0.123 *** (0.0222)
Vitamin A (%DV)	0.00562 * (0.00234)
Vitamin C (%DV)	0.0137 *** (0.00399)
Calcium (%DV)	0.0685 *** (0.0137)
Iron (%DV)	-0.0186 (0.0186)

Significance codes: *** $p < 0.001$ ** $p < 0.01$ * $p < 0.05$

APPENDIX A

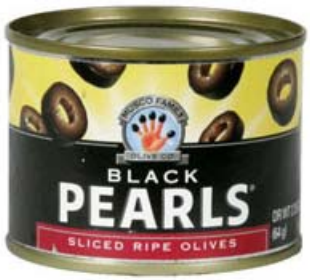
Survey screenshot

Food/Beverage 1 of 205

Black Pearls Ripe Olives Sliced

Nutrition Facts
Serving size 2 TBSP
Servings per container 4

Amount per serving	
Calories 25	Calories from fat 25
	% Daily Value
Total Fat 2.5g	4%
Saturated Fat 0g	0%
Cholesterol 0mg	0%
Sodium 125mg	5%
Total Carbohydrate 1g	0%
Dietary Fiber 0g	0%
Sugars 0g	
Protein 0g	
Vitamin A 0%	Vitamin C 0%
Calcium 0%	Iron 0%



How would you rate this food/beverage on a scale from -5="very unhealthy" to 5="very healthy"?

-5	-4	-3	-2	-1	0	1	2	3	4	5
○	○	○	○	○	○	○	○	○	○	○

Submit

APPENDIX B

Example calculations of predicted rating for two sample foods (Morningstar Farms Meatless Breakfast Patties, which received a relatively high actual average rating of 1.69, and Boston Market Double Chocolate Pudding, which received a relatively low actual average rating of -1.77):

Predicted rating for one Morningstar Farms Meatless Breakfast Patty

$$= 0.710 - 0.0538*3 - 0.423*0.5 - 0.00398*0 - 0.00254*270 - 0.0300*3 + 0.561*2 - 0.0245*1 + 0.123*10 + 0.00562*0 + 0.0137*0 + 0.0685*0 - 0.0186*10$$

$$= 1.70$$

Predicted rating for one 4oz. serving of Boston Market Double Chocolate Pudding

$$= 0.710 - 0.0538*7 - 0.423*4.5 - 0.00398*40 - 0.00254*170 - 0.0300*27 + 0.561*1 - 0.0245*22 + 0.123*4 + 0.00562*1 + 0.0137*3 + 0.0685*10 - 0.0186*3$$

$$= -1.78$$

APPENDIX C

The average model predictions across items within each of the 205 product categories, ordered from highest average predicted rating to lowest average predicted rating.

Category Name	Average Predicted Rating
DRIED BEANS (GENERIC)	7.87
NATURAL SUPPLEMENTS	7.86
CITRUS (FRESH)	3.68
INSTANT BREAKFAST	3.67
NUTRITIONAL FOODS/BEVRGE	3.37
SKIM MILK	3.35
DIET AIDS	3.34
SPINACH (FRESH)	3.26
ORGANIC FRUITS (FRESH)	3.26
BERRIES (FRESH)	3.17
SOY MILK	3.11
BAKED BEANS (GENERIC)	2.91
ORGANIC VEGETABLES(FRESH)	2.69
ALL OTHR FRESH VEGETABLES	2.67
MEAT SUBSTITUTE (FROZEN)	2.37
POTATOES/ONIONS (FRESH)	2.32
ALL OTHER RFG BEVRGE	2.12
PEARS (FRESH)	2.07
MILK SUBSTITUTES	2.07
CUCUMBERS/PICKLES (FRESH)	2.06
PKGED SALAD MIX (FRESH)	1.83
ALL OTHER VEGETABLES (GENERIC)	1.79
STONE FRUITS (FRESH)	1.79
LETTUCE (FRESH)	1.77
BAGELS	1.70
HOT CEREAL/OATMEAL	1.67
JUICE (RFG)	1.66
FLOURS/CORNMEAL	1.63
BANANAS (FRESH)	1.61
ORGANIC MILK	1.58
ALL OTHER FRESH FRUIT	1.57
CHILI (GENERIC)	1.56
LAMB/VEAL (FRESH)	1.54
TUNA (GENERIC)	1.50
FISH (FRESH)	1.49
ROLLS/BUNS (FRESH)	1.43
BREAD LOAVES	1.41
PASTA (GENERIC)	1.39

RTE CEREAL	1.39
TOMATOES (FRESH)	1.39
SOY/RICE DRINKS (GENERIC)	1.35
CONDNSD/EVAP/PWDRD MILK	1.27
ALL OTHER BAKERY (COMM.)	1.27
ALL OTHER FRESH MEAT	1.27
BAGELS (FRESH)	1.19
STANDARD MILK	1.16
RICOTTA CHEESE	1.13
APPLESAUCE (GENERIC)	1.11
ALL OTHER MILK	1.09
BAKING NUTS	1.08
BREAD (FRESH)	1.06
TOMATO PRODUCTS (GENERIC)	1.04
BUNS/ROLLS	0.84
SNACK NUTS/SEEDS	0.83
LAMB/VEAL (FROZEN)	0.80
SALAD TOPPINGS	0.77
HERBS (FRESH)	0.76
COTTAGE CHEESE	0.74
ALL OTHER FRUIT (GENERIC)	0.73
WATER - CARBONATED	0.72
WATER - NON-CARBONATED	0.72
WHOLE COFFEE BEANS	0.71
COOKING SPRAYS	0.71
APPLES (FRESH)	0.70
TURKEY (FRESH)	0.70
STRING CHEESE	0.66
SUGAR SUBSTITUTES	0.66
VINEGARS	0.62
DRIED FRUIT	0.60
DIET SODA	0.60
HOT/INSTANT TEA	0.59
PIE/PASTRY FILLINGS	0.58
BRKFST BARS/GRANOLA SNCKS	0.57
SHELLFISH (FROZEN)	0.57
TURKEY (FROZEN)	0.56
MUSTARD	0.54
POPCORN (UNPOPPED)	0.52
DRINKS (RFG)	0.51
ALL OTHER DRIED BREAD	0.51
COFFEE CREAMER (FROZEN)	0.49
RICE/CORN CAKES	0.46
SALSA	0.45
COOKING WINES	0.45
TORTILLA CHIPS	0.44
JUICE (FROZEN)	0.42
SEAFOOD ALL OTHER (GENERIC)	0.39
SALTINE CRACKERS	0.38
HOT CHOCOLATE MIX	0.37

ICE CREAM CONES	0.33
PANCAKE/WAFFLE MIX	0.33
GUM & MINTS	0.33
GELATIN SNACKS (RFG)	0.32
INSTANT POTATOES	0.30
GELATIN MIXES	0.29
PEANUT BUTTER	0.28
SLICED CHEESE	0.27
ALL OTHER PACKAGED DELI	0.27
SHREDDED/GRATED CHEESE	0.27
SUGAR	0.26
OLIVE/PICKLE/PEPPERS (GENERIC)	0.23
POPCORN (POPPED)	0.23
DELI MEATS (BULK)	0.22
BAGELS (FROZEN)	0.18
STUFFING/BRDCRMBS/CROUTNS	0.18
PUDDING MIXES	0.13
CHICKEN (FRESH)	0.11
KETCHUP	0.10
BREAD MIXES	0.10
JAM/JELLIES/SPREADS	0.08
SNACK/SPECIALTY CRACKERS	0.02
COFFEE CREAMER (RFG)	0.00
INSTANT COFFEE	-0.01
SNACK MIXES	-0.02
PRETZELS	-0.03
RTD TEA	-0.04
ALL OTHER SALTY SNACKS	-0.07
ALL OTHER CONDIMENTS	-0.07
DIPS (GENERIC)/DIP MIX	-0.11
CORN CHIPS/SNACKS	-0.13
ALL OTHER CRACKERS	-0.13
GRAHAM CRACKERS	-0.14
CONDENSED SOUP	-0.17
ALL OTHER FROZEN MEAT	-0.19
HONEY	-0.19
RICE/COUSCOUS	-0.21
MARSHMALLOWS	-0.21
COFFEE DRINKS (RTD)	-0.21
RTE SOUP	-0.27
DELI CHEESE (BULK)	-0.27
PASTA MIXES	-0.28
GROUND COFFEE	-0.28
DOUGH (FROZEN)	-0.29
MAYO/SANDWICH SPREADS	-0.31
CHUNK CHEESE	-0.32
ISOTONIC DRINKS	-0.34
ALL OTHER CHEESE	-0.34
CHICKEN (FROZEN)	-0.38
POTATO CHIPS	-0.38

COFFEE CREAMER (GENERIC)	-0.39
HALF & HALF/CREAM	-0.39
ALL OTHER FROZEN BREAD	-0.41
MARGARINE/SPREADS	-0.43
GELATIN SNACKS (GENERIC)	-0.43
DELI PREPACK	-0.44
BBQ SAUCE/STEAK SAUCE	-0.49
FISH (FROZEN)	-0.52
ALL OTHER FRZN SEAFOOD	-0.53
BROWNIES (FRESH)	-0.54
PUDDING SNACKS (RFG)	-0.59
BROWNIE/COOKIE/MUFFIN MIX	-0.60
DRINKS (FROZEN)	-0.62
MUFFINS (FRESH)	-0.62
FRZN WAFFLE/PANCAKE/TOAST	-0.64
RICE/COUSCOUS MIXES	-0.66
ALL OTHR PREPD FOODS (GENERIC)	-0.67
PUDDING SNACKS (GENERIC)	-0.72
ALL OTHER FRESH SEAFOOD	-0.74
HAM/PORK (FRESH)	-0.76
ALL OTHER COOKING OILS	-0.77
SOUP MIXES	-0.84
CANDY NON-CHOCOLATE	-0.84
DELI PREPARED SIDE DISHES	-0.85
OLIVE OIL	-0.89
DELI SALADS (BULK)	-0.90
DONUTS (FRESH)	-0.91
MAC & CHEESE MIXES	-0.97
CHEESE SNACKS	-1.00
REGULAR SODA	-1.02
ICE CREAM TOPPINGS	-1.02
BROTH/BOULLION	-1.04
SALAD DRESSINGS	-1.04
ALL OTHR DRY DINNER MIXES	-1.11
HAM/PORK (FROZEN)	-1.15
COOKIES (FRESH)	-1.18
SHORTENING/LARD	-1.20
TOASTER/TART PASTRIES	-1.28
FROZEN NOVELTIES	-1.33
BEEF (FRESH)	-1.34
ALL OTHER ICE CREAM	-1.36
CANNED PASTA (GENERIC)	-1.38
ALL OTHER FROZEN BEVRGE	-1.41
CREAM CHEESE	-1.42
ALL OTHER BAKING MIXES	-1.43
BREAKFAST SYRUP	-1.44
BAKING CHOC/MORSL/COCONUT	-1.47
DELI PREPARED ENTREES	-1.48
FROSTING	-1.63
SAUSAGE (FROZEN)	-1.67

ALL OTHER FRESH DELI	-1.70
DELI PREPARED DESSERTS	-1.78
MEAT (GENERIC)	-1.87
ICE CREAM/SORBET/FZN YGRT	-1.97
CAKE MIXES	-2.02
SWEET GOODS	-2.05
BACON/BREAKFAST SAUSAGE	-2.09
BEEF (FROZEN)	-2.26
CAKES (FRESH)	-2.29
CANDY CHOCOLATE	-2.40
ALL OTHER FRZN BREAKFAST	-2.46
BUTTER	-2.56
SAUSAGE (FRESH)	-2.70
HOT DOGS/SAUSAGE/BRATS	-2.84
PIES (FRESH)	-2.86
ALL OTHER FRESH BAKERY	-3.53
PRE-MADE LUNCH PACKS	-3.65

APPENDIX D

The model predictions for all items listed under the category “All Other Salty Snacks,” ordered from highest predicted rating to lowest predicted rating.

Food in the “All Other Salty Snacks” Category	Predicted Rating
Guiltless Gourmet Guiltless Carbs Chips Three Pepper	2.97
Guiltless Gourmet Guiltless Carbs Chips Southwestern Ranch	2.84
Guiltless Gourmet Guiltless Carbs Chips Salsa Verde	2.84
Snyder's of Hanover EatSmart Soy Teins Parmesan, Garlic & Olive Oil	2.29
Snyder's of Hanover EatSmart Soy Teins Tomato, Romano & Olive Oil	2.24
Glenny's Soy Crisps Barbeque Low Fat	1.96
Glenny's Soy Crispy Wispys White Cheddar	1.65
Glenny's Soy Crisps Light Low Fat Salted	1.51
Calbee Snack Salad Snapea Crisps Original	1.25
Calbee Snack Salad Snapea Crisps Caesar	1.16
Terra Vegetable Chips Exotic	1.13
Cedar's Hommus Pita Scoopers Plain	0.73
Cedar's Hommus Pita Scoopers Garlic	0.58
Frito-Lay Sun Chips French Onion	0.42
Frito-Lay Sun Chips Original	0.39
Snyder's of Hanover EatSmart Veggie Crisps Sundried Tomato & Pesto Natural	0.37
Frito-Lay Sun Chips French Onion	0.35
Frito Lay Sun Chips Cheddar Flavor	0.28
Frito-Lay Sun Chips Harvest Cheddar	0.27
Frito-Lay Sun Chips Original	0.23
Oberto Beef Jerky	0.23
Roberts American Gourmet Pirates Booty Puffed Rice Corn Snack Caramel	0.08
Snyder's of Hanover EatSmart Veggie Crisps 100% Natural	0.05
Oberto Beef Jerky Teriyaki	0.05
Oberto Beef Jerky Barbecue	-0.03
Utz Lunch Box Snack Packs Regular 12 Count	-0.31
Utz Mega Variety Snack Pack 1 oz ea - 42 ct	-0.31
Snyder's of Hanover EatSmart Veggie Crisps Jalapeno & Cheddar 100% Natural	-0.31
Funyuns 12-Sack	-0.32
Wild Oats Natural Rice Snacks Oriental	-0.36
Wild Oats Natural Sesame Sticks	-0.50
Frito-Lay Munchies Snack Mix	-0.52
Osem Bamba Snacks Peanut	-0.72
Nature's Promise Vegetable Chips All Natural	-0.84
Slim Jim Beef Jerky - 4 ct	-0.89
Nature's Promise Vegetable Sticks All Natural	-0.93
French's Potato Sticks Original	-0.98
Osem Bissli Snacks Barbecue	-0.99

Osem Bissli Snacks Taco	-1.00
Osem Bissli Snacks Smokey	-1.27
Osem Bissli Snacks Pizza	-1.28
French's Potato Sticks Original	-1.59
Slim Jim Smoked Snacks Spicy - 15 ct	-2.55
Slim Jim Smoked Snacks Mild - 15 ct	-2.55
Jays O-KE-DOKE Corn Puffs	-2.61
Slim Jim Smoked Snacks Spicy - 5 ct	-4.09
Slim Jim Smoked Snacks Mild - 5 ct	-4.09