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Nutrition labels of foods: friends or foes in public health? Critical vulnerabilities of U.S. FDA Nutrition Facts label and invention of a reliable Nutrition Facts label

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Abstract

Nutrition labels on packaged foods or on shelf tags are used to help the general population make informed food choices to reduce or prevent diet-associated chronic diseases and meet nutritional needs. However, inaccurate nutrition labeling can mislead consumers by providing unsuitable nutritional assessments, which can elevate the risk of certain chronic diseases and cause huge medical costs. A study of 8,596 foods from the National Nutrient Database of the U.S. Department of Agriculture (USDA) revealed that only 0.2% of foods are customarily consumed 100 g or 100 mL per eating occasion. Thus, it is not reasonable to provide nutrient information based on 100 g or 100 mL on nutrition labels. Despite the fact that providing nutrient information based on 100 g or 100 mL on nutrition labels is an incorrect approach, unfortunately, most of the nutrient regulations in the world are based on 100 g or 100 mL. The Nutrition Facts label regulated by the U.S. Food and Drug Administration (FDA): (1) cannot make a significant contribution to the prevention or reduction of obesity and overweight; (2) makes food choices difficult and time-consuming; (3) helps consumers choose some foods containing excessive energy; (4) helps consumers choose some foods high in negative nutrients (including energy/calories, *trans* fat, saturated fat, sodium, cholesterol, sugars, and fat); (5) discourages consumers from choosing some foods low in negative nutrients; (6) helps consumers choose foods high in *trans* fat or saturated fat and low in cholesterol; (7) helps consumers choose some small serving foods high in negative nutrients; (8) discourages consumers from choosing some nutritious foods; (9) eliminates the ability of consumers to monitor their intake of many positive nutrients and to identify and compare foods in terms of many positive nutrients; (10) encourages unsuitable or excessive uses of fortification; and (11) promotes fortified foods and degrades unfortified foods. The proposed Nutrition Facts label helps individuals who desire to comply with dietary recommendations from health care providers or public health guidance. The proposed Nutrition Facts label is an accurate, convenient, and quick information tool for making informed food choices to reduce or prevent diet-associated chronic diseases and to meet nutritional needs in the context of daily energy needs.

Keywords Nutrition Facts panel, Nutrition labeling, Nutrition information, Food choice, Front-of-package nutrition systems, Back-of-package nutrition labeling, Nutrient content claims, Nutritional quality, Nutritional value, Nutrition rating system, Obesity, Public health, Food policy, Diet-related chronic diseases

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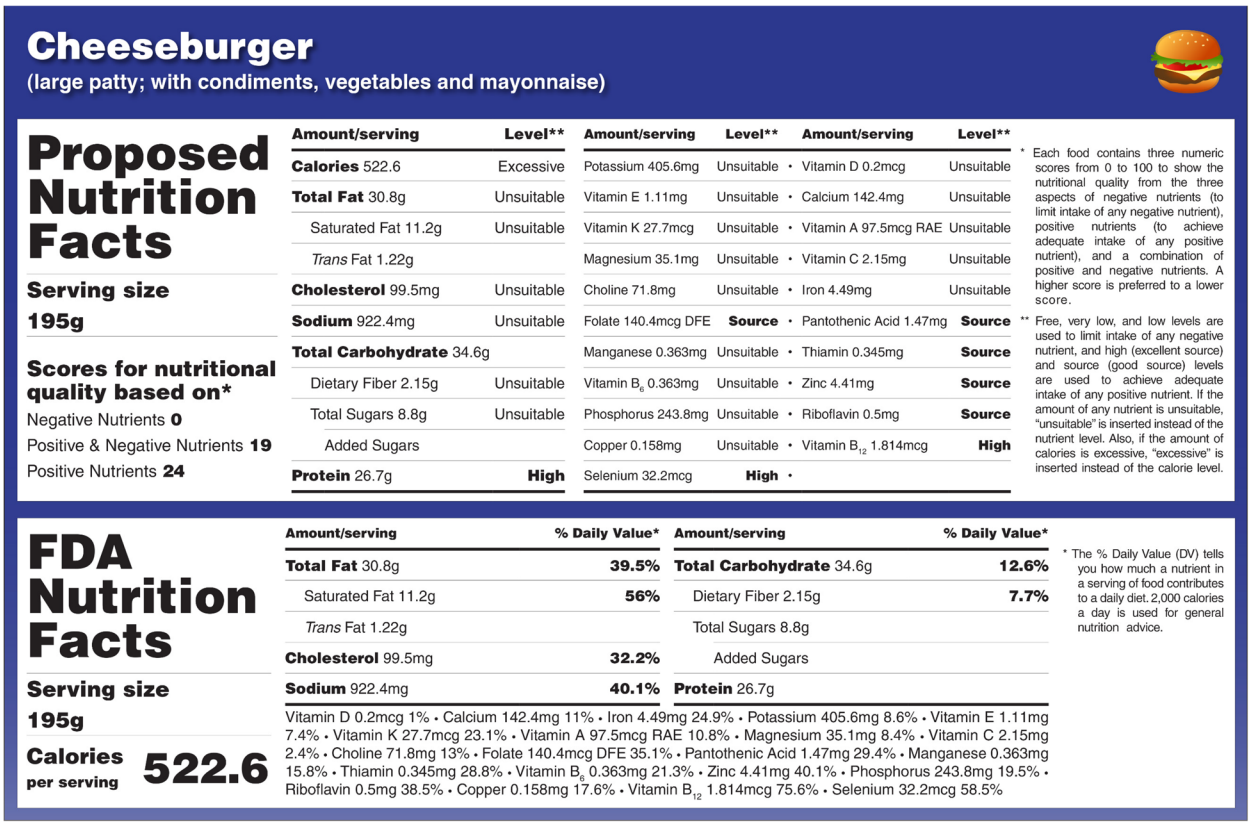
Graphical Abstract



Introduction

Humans need nutrients (food components) to survive. However, excessive intakes of negative nutrients or inadequate intakes of positive nutrients can harm human health. Thus, negative nutrients such as energy (calories), *trans* fat, saturated fat, sodium, cholesterol, fat, and sugars should be limited in the diet, and positive nutrients such as minerals (except sodium), vitamins, protein, and dietary fiber should be encouraged in the diet (Forouzesh et al., 2024). Nutrients are mainly obtained through food consumption. So, it is very important to make informed food choices to limit intakes of negative nutrients and to achieve adequate intakes of positive nutrients.

Due to the importance of making informed food choices, most packaged foods in many countries are labeled with Nutrition Facts (also known as nutrition information or nutrition label). Global interest in nutrition labeling has surged as a policy instrument that allows governments to steer consumers towards informed food purchases and healthier dietary choices (WHO, 2019). This heightened interest coincides with the rising prevalence of diet-related noncommunicable diseases (NCDs) and the generally low adherence to dietary guidelines among populations (WHO, 2019). Overweight and obesity are significant public health concerns within the European Union (Storcksdieck genannt Bonsmann & Wills, 2012). Currently, over half of U.S. adults suffer from one or more diet-related chronic diseases (HHS & USDA, 2020). Approximately two-thirds of U.S. adults and around one-third of children and adolescents aged 2 to 19 are overweight or obese (HHS & USDA, 2020; Ogden et al., 2010). Additionally, the prevalence of chronic diseases and behaviors that heighten the risk for these diseases remain alarmingly high (Ford et al., 2007, 2008; HHS & USDA, 2020). Consequently, there is a pressing need for the majority of the population to make healthier food choices (IOM, 2010). The

nutrition labeling would be best geared toward the general population (IOM, 2010). Nutrition labels on packaged foods represent a cost-effective intervention at the population level, with extensive reach (Campos et al., 2011). Enhanced nutrition can lead to reduced healthcare costs (Dumoitier et al., 2019). For instance, modest caloric reductions (100 calories per day) across the U.S. population could potentially save up to $58 billion in annual medical expenses (Dall et al., 2009). Many of the estimated prevented or delayed deaths were also linked to reductions in average calorie intake, with an average decrease of 122 calories per day for men and 90 calories per day for women (Labonté et al., 2019).

Several nutrition labels have been established so far, and the Nutrition Facts label regulated by the FDA is one of the most important among existing nutrition labels. All existing nutrition labels are associated with many vulnerabilities so that they cannot properly help consumers make informed food choices. Despite the widespread availability of nutrition information on most foods in the United States, obesity rates among children and adults continue to climb (Temple et al., 2011). This indicates that individuals either do not utilize or do not comprehend the information on the Nutrition Facts label (Temple et al., 2011). The need for accurate nutrition labeling on food products has never been greater (Kasapila & Shaarani, 2016).

Nutrition labels on packaged foods or on shelf tags are used to help the general population make informed food choices to reduce or prevent diet-associated chronic diseases and meet nutritional needs. However, inaccurate nutrition labeling can mislead consumers by providing unsuitable nutritional assessments, which can elevate the risk of certain chronic diseases and cause huge medical costs. So, inaccurate nutrition labeling should be avoided. This study addresses some vulnerabilities of the FDA Nutrition Facts label and introduces a new Nutrition Facts label. Also, because most of the nutrient regulations in the world are based on 100 g or 100 mL, vulnerabilities of providing nutrient information based on 100 g or 100 mL on nutrition labels are discussed in this study, too.

Methods

Foods and nutrients

Information on food and nutrient profiles was prepared from the Standard Reference release 28 of the USDA National Nutrient Database (USDA ARS, 2016).

Daily values for energy

In this study, the Daily Values (DVs) for energy were set at 2,000 calories (2,000 kcal) for adults and children aged 4 years and older, and at 1,000 calories (1,000 kcal) for children aged 1 to 3 years (21CFR101.9, revised as of Dec 22, 2023).

Reference amount customarily consumed (RACC)

RACC values represent the amount (edible portion) of food customarily consumed per eating occasion (FDA, 2018). These values were assigned to foods based on guidance from the Office of Nutrition and Food Labeling (FDA, 2018).

Percent daily value

The percent Daily Value (% DV) tells you how much a nutrient in a specified amount of food contributes to a daily diet (21CFR101.9, revised as of Dec 22, 2023). The % DV per serving and the % DV per 100 g or 100 mL for any nutrient are calculated by formulas 1 and 2, respectively.

$$\text{Formula 1}: \%\,\text{DV per serving} = (\text{nutrient amount per serving} \div \text{DV for nutrient}) \times 100$$

$$\text{Formula 2}: \%\,\text{DV per 100 g or 100 mL} = (\text{nutrient amount per 100 g or 100 mL} \div \text{DV for nutrient}) \times 100$$

Nutrient content claims specifying nutrient levels

Nutrient content claims characterize the level of a nutrient in food with descriptive terms, including free, very low, low, source, and high (Rowlands & Hoadley, 2006). The claims of free, very low, and low are used to limit intake of any negative nutrient, and the claims of high (excellent source) and source (good source) are used to achieve adequate intake of any positive nutrient (Forouzesh et al., 2024). The claims of high, source, low, very low, and free for nutrients show the amount of nutrients at high, mid, low, very low, and insignificant levels, respectively (Forouzesh et al., 2024). The claims of free, very low, and low are specified levels for negative nutrients, while the claims of high and source are specified levels for positive nutrients. The claims of free, very low, low, source, and high for nutrients are provided on the basis of the FDA regulations in IOM (2010) and the proposed Nutrition Facts label in Forouzesh et al. (2021a, 2021b, 2022, 2023a, 2023b, 2024).

Nutritional quality of foods

The assessment of a food by considering the amounts of various nutrients that should be either encouraged or limited is called nutritional quality or nutritional value. The result of nutritional quality assessment is usually shown by a score or symbol. The nutritional quality of foods can be assessed from three aspects, including negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients (to achieve adequate intake of any positive nutrient and to limit intake of any negative nutrient) (Forouzesh et al., 2024). The proposed Nutrition Facts label provides three numeric scores from 0 to 100 to show the nutritional quality of each food from the three aspects of negative nutrients, positive nutrients, and a combination of positive and negative nutrients. A higher score is preferred to a lower score. The method for calculating nutritional quality scores on the proposed Nutrition Facts label is provided on the basis of the study by Forouzesh et al. (2024).

The FDA Nutrition Facts label

The FDA Nutrition Facts label includes a declaration of serving size (the serving size or serving is obtained from the RACC), which is represented in a usual household measure (e.g., tablespoon or cup). The FDA Nutrition Facts label requires information on energy (calories), total fat, saturated fat, *trans* fat, cholesterol, sodium, total carbohydrate, dietary fiber, total sugars, added sugars, protein, vitamin D, calcium, iron, and potassium. Additional nutrients must be listed when they are added to a food or when specific claims are made about them (IOM, 2010). The FDA Nutrition Facts label supplies nutrient information as an amount per serving and a % DV per serving (energy/calories, *trans* fat, total sugars, and protein do not have a % DV). The FDA Nutrition Facts label may be displayed in one of the formats, including vertical, tabular, aggregate, dual column, simplified, and linear. A sample of the vertical display of the FDA Nutrition Facts label, including some voluntary nutrients listed side-by-side, is shown in Fig. 1.

Nutrition Facts

Serving size	**1 cup (198g)**
Amount per serving	
Calories	**376.2**
	% Daily Value*
Total Fat 16.4g	**21%**
Saturated Fat 3.6g	**18%**
Trans Fat 2.45g	
Cholesterol 6mg	**2%**
Sodium 669mg	**29.1%**
Total Carbohydrate 47.4g	**17.2%**
Dietary Fiber 2.38g	**8.5%**
Total Sugars 8.5g	
Includes 0g Added Sugars	**0%**
Protein 9.7g	

Calcium 124.7mg 9.6%	•	Iron 1.96mg 10.9%
Potassium 255.4mg 5.4%	•	Vitamin K 12.7mcg 10.6%
Magnesium 33.7mg 8%	•	Choline 53.3mg 9.7%
Folate 225.7mcg DFE 56.4%	•	Pantothenic Acid 0.855mg 17.1%
Manganese 0.467mg 20.3%	•	Thiamin 0.35mg 29.2%
Vitamin B_6 0.121mg 7.1%	•	Zinc 0.93mg 8.5%
Phosphorus 221.8mg 17.7%	•	Riboflavin 0.352mg 27.1%
Copper 0.147mg 16.3%	•	Vitamin B_{12} 0.317mcg 13.2%
Selenium 24.75mcg 45%	•	

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Fig. 1 A sample of the vertical display of the FDA Nutrition Facts label, including some voluntary nutrients listed side-by-side

The proposed Nutrition Facts label

The proposed Nutrition Facts label includes a declaration of serving size (the serving size or serving is obtained from the RACC), which is represented in a usual household measure. The proposed Nutrition Facts label requires information on energy (calories), total fat, saturated fat, *trans* fat, cholesterol, sodium, total carbohydrate, dietary fiber, total sugars, added sugars, protein, vitamins, and minerals. The proposed Nutrition Facts label supplies nutrient information as an amount per serving (the serving is obtained from the RACC) and a level per serving (the serving is obtained from the RACC or other suitable amounts) (*trans* fat, total carbohydrate, and added sugars do not have a level).

The levels of free, very low, and low are used to limit intake of any negative nutrient, and the levels of high (excellent source) and source (good source) are used to achieve adequate intake of any positive nutrient. If the amount of any nutrient is unsuitable, "unsuitable" is inserted instead of the nutrient level. Also, if the amount of energy (calories) is excessive, "excessive" is inserted instead of the energy (calorie) level. Methods for determining specified levels of nutrients on the proposed Nutrition Facts label are provided on the basis of studies by Forouzesh et al. (2021a, 2021b, 2022, 2023a, 2023b, 2024).

Summary information on the nutritional quality of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients (to achieve adequate intake of any positive nutrient and to limit intake of any negative nutrient) is shown as three numeric scores from 0 to 100 on the proposed Nutrition Facts label. A higher score is preferred to a lower score. The method for calculating nutritional quality scores on the proposed Nutrition Facts label is provided based on the study by Forouzesh et al. (2024).

The proposed Nutrition Facts label, similar to the FDA Nutrition Facts label, may be displayed in one of the formats. A sample of the vertical display of the proposed Nutrition Facts label with micronutrients listed side-by-side is shown in Fig. 2.

Sufficient continuous space to include the needed components of the proposed Nutrition Facts label on the package of some foods is limited. Thus, part of the proposed Nutrition Facts label can be displayed on the food package, and the proposed Nutrition Facts label can be placed in a machine-readable form or on a web page so that consumers can get the complete nutrition label for each food by scanning the specified part of the food package.

Results

Vulnerabilities of making food choices based on reference amounts of food and nutrient content claims

To know the amounts (contents or quantities) of nutrients in each food, the food amount is specified, and then, the amounts of nutrients are measured in the specified amount of food. The nutrient amount is directly correlated with the food amount, so raising the food amount elevates the nutrient amount, and reducing the food amount diminishes the nutrient amount (excluding food without nutrients) (Forouzesh et al., 2024). Thus, amounts of foods affect the amounts of nutrients and food choices.

Amounts of nutrients are mainly measured in the reference amounts of 100 g or 100 mL, RACC, or 100 kcal of food. Several studies have shown that making some food choices according to reference amounts of food can increase the risk of certain diet-associated chronic diseases because measuring the amounts of nutrients in reference amounts of food unsuitably shows the amounts of nutrients for some foods (Forouzesh et al., 2021a, 2021b, 2022, 2023a, 2023b, 2024). Among reference amounts of food, 100 kcal is rarely seen on nutrition labels and is mainly used in some scientific literature.

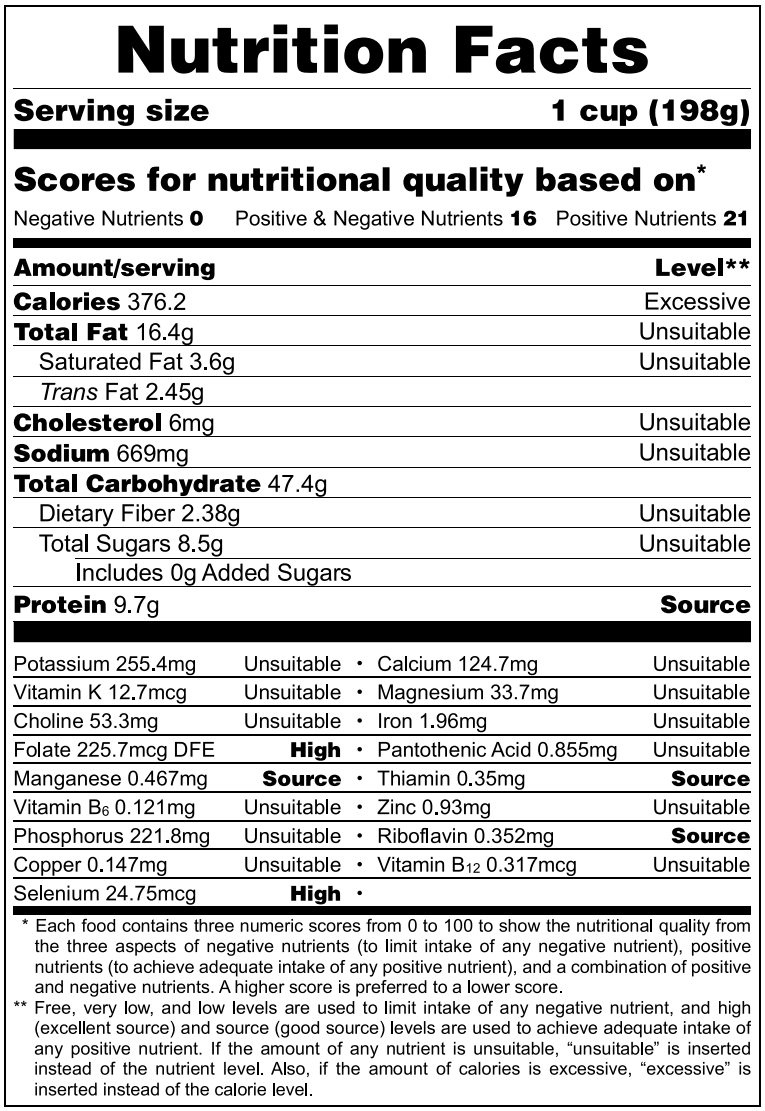
Nutrient information is usually displayed in one or more ways on nutrition labels:

(i) The amount of nutrient per serving (the serving is obtained from the RACC) or 100 g or 100 mL (e.g., 115 mg of sodium per serving or 4 mcg of vitamin D per serving), which is used to monitor intakes of nutrients.

(ii) The amount of nutrient per serving (the serving is obtained from the RACC) or 100 g or 100 mL in the context of a daily diet expressed as a % DV (e.g., 5% of the DV for sodium per serving or 20% of the DV for vitamin D per serving), which is used to compare foods in terms of any nutrient.

(iii) The amount of nutrient per serving (the serving is obtained from the RACC or other amounts) or 100 g or 100 mL in the context of a daily diet expressed as the level of a nutrient (e.g., low sodium or high vitamin D), which is used to interpret information for individual nutrients and to identify and compare foods in terms of any nutrient. Criteria for specifying the level of the target nutrient can include the amount of the target nutrient and other factors affecting the target nutrient.

(iv) Amounts of many different nutrients per serving (the serving is obtained from the RACC or other amounts) or 100 g or 100 mL expressed as a nutritional quality score or symbol, which is used to interpret information for many nutrients and to identify and compare foods in terms of many



Nutrition Facts

Serving size **1 cup (198g)**

Scores for nutritional quality based on*

Negative Nutrients **0** Positive & Negative Nutrients **16** Positive Nutrients **21**

Amount/serving	**Level****
Calories 376.2	Excessive
Total Fat 16.4g	Unsuitable
Saturated Fat 3.6g	Unsuitable
Trans Fat 2.45g	
Cholesterol 6mg	Unsuitable
Sodium 669mg	Unsuitable
Total Carbohydrate 47.4g	
Dietary Fiber 2.38g	Unsuitable
Total Sugars 8.5g	Unsuitable
Includes 0g Added Sugars	
Protein 9.7g	**Source**

Potassium 255.4mg	Unsuitable	•	Calcium 124.7mg	Unsuitable
Vitamin K 12.7mcg	Unsuitable	•	Magnesium 33.7mg	Unsuitable
Choline 53.3mg	Unsuitable	•	Iron 1.96mg	Unsuitable
Folate 225.7mcg DFE	**High**	•	Pantothenic Acid 0.855mg	Unsuitable
Manganese 0.467mg	**Source**	•	Thiamin 0.35mg	**Source**
Vitamin B_6 0.121mg	Unsuitable	•	Zinc 0.93mg	Unsuitable
Phosphorus 221.8mg	Unsuitable	•	Riboflavin 0.352mg	**Source**
Copper 0.147mg	Unsuitable	•	Vitamin B_{12} 0.317mcg	Unsuitable
Selenium 24.75mcg	**High**	•		

* Each food contains three numeric scores from 0 to 100 to show the nutritional quality from the three aspects of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients. A higher score is preferred to a lower score.

** Free, very low, and low levels are used to limit intake of any negative nutrient, and high (excellent source) and source (good source) levels are used to achieve adequate intake of any positive nutrient. If the amount of any nutrient is unsuitable, "unsuitable" is inserted instead of the nutrient level. Also, if the amount of calories is excessive, "excessive" is inserted instead of the calorie level.

Fig. 2 A sample of the vertical display of the proposed Nutrition Facts label with micronutrients listed side-by-side

nutrients. NuVal, Nutri-Score, Health Star Rating, and the endorsement logo (such as Keyhole) are some summary indicator systems to evaluate the nutritional quality of foods. A reliable method to evaluate the nutritional quality of foods from three aspects of negative nutrients, positive nutrients, and a combination of positive and negative nutrients has been developed by Forouzesh et al. (2024), which uses nutrient levels (nutrient content claims specifying nutrient levels) to evaluate the nutritional quality of foods.

The vulnerabilities of providing nutrient information based on 100 g (for solid foods) or 100 mL (for liquid foods) on nutrition labels are as follows:

(1) Measuring the amounts of negative nutrients per 100 g or 100 mL of food unrealistically understates the amounts of negative nutrients for foods that are customarily consumed more than 100 g or 100 mL per eating occasion. A study of 8,596 foods from the National Nutrient Database of the USDA revealed that measuring the amounts of negative nutrients per 100 g or 100 mL of food understates the amounts of negative nutrients for 43.2% of foods. For example, pulled pork in barbecue sauce (NDB number 22972) is customarily consumed 249 g per eating occasion (3.526 g of saturated fat per 249 g). Thus, measuring the saturated fat amount of pulled pork in barbecue sauce per 100 g shows the saturated fat amount of this food unrealistically 2.49 times lower (1.416 g of saturated fat per 100 g).

(2) Measuring the amounts of positive nutrients per 100 g or 100 mL of food unrealistically understates the amounts of positive nutrients for some foods that are customarily consumed more than 100 g or 100 mL per eating occasion. A study of 8,596 foods from the National Nutrient Database of the USDA revealed that measuring the amounts of positive nutrients per 100 g or 100 mL of food understates the amounts of positive nutrients for 34.6% of foods. For example, chunky vegetable soup (NDB number 27060) is customarily consumed 245 g per eating occasion (855.05 mg of potassium per 245 g). Thus, measuring the potassium amount of chunky vegetable soup per 100 g shows the potassium amount of this food unrealistically 2.45 times lower (349 mg of potassium per 100 g).

(3) Measuring the amounts of negative nutrients per 100 g or 100 mL of food unrealistically exaggerates the amounts of negative nutrients for foods that are customarily consumed less than 100 g or 100 mL per eating occasion. A study of 8,596 foods from the National Nutrient Database of the USDA revealed that measuring the amounts of negative nutrients per 100 g or 100 mL of food exaggerates the amounts of negative nutrients for 56.6% of foods. For example, pickled eggplant (NDB number 43146) is customarily consumed 30 g per eating occasion (14.7 calories per 30 g). Thus, measuring the energy (calorie) amount of pickled eggplant per 100 g shows the energy amount of this food unrealistically 3.3 times higher (49 calories per 100 g).

(4) Measuring the amounts of positive nutrients per 100 g or 100 mL of food unrealistically exaggerates the amounts of positive nutrients for foods that are customarily consumed less than 100 g or 100 mL per eating occasion. A study of 8,596 foods from the National Nutrient Database of the USDA revealed that measuring the amounts of positive nutrients per 100 g or 100 mL of food exaggerates the amounts of positive nutrients for 65.2% of foods. For example, Feta cheese (NDB number 1019) is customarily consumed 30 g per eating occasion (147.9 mg of calcium per 30 g). Thus, measuring the calcium amount of Feta cheese per 100 g shows the calcium amount of this food unrealistically 3.3 times higher (493 mg of calcium per 100 g).

(5) Measuring the amounts of positive nutrients per 100 g or 100 mL of food exaggerates the amounts of positive nutrients for foods containing excessive energy because the amounts of positive nutrients are measured without regarding the energy amounts of foods. Since consuming foods containing excessive energy is associated with receiving a significant portion of the DVs for energy per eating occasion, achieving the DVs for positive nutrients by consuming these foods can result in exceeding the DVs for energy, which can lead to obesity or overweight. For example, consuming 100 g of braised beef short ribs (lean and fat; NDB number 13148) meets 14.95% of the DV for choline. So, the food item of braised beef short ribs is a source (good source) of choline based on consuming 100 g per eating occasion. Since consuming 100 g of braised beef short ribs is associated with receiving a significant portion of the DV for energy per eating occasion (23.55% of the DV for energy per 100 g), achieving the DV for choline by consuming this food results in receiving 157.6% of the DV for energy. In addition, consuming braised beef short ribs as much as the DV for energy results in receiving 63.5% of the DV for choline. Thus, despite having 14.95% of the DV for choline per 100 g, the food item of braised beef short ribs is unsuitable for achieving the DV for choline due to its excessive energy.

(6) Most foods are customarily consumed in amounts greater or less than 100 g or 100 mL per eating occasion, it is very difficult to monitor intakes of nutrients through nutrition labels based on 100 g or 100 mL. Also, % DVs for nutrients, nutrient levels, and nutritional quality scores or symbols on nutrition labels are unsuitably displayed based on 100 g or 100 mL in many foods, which can mislead consumers. A study of 8,596 foods from the National Nutrient Database of the USDA revealed that only 0.2% of foods are customarily consumed 100 g or 100 mL per eating occasion. Thus, it is not reasonable to provide nutrient information based on 100 g or 100 mL on nutrition labels. Despite the fact that providing nutrient information based on 100 g or 100 mL on nutrition labels is an incorrect approach, unfortunately, most of the nutrient regulations in the world are based on 100 g or 100 mL.

The vulnerabilities of expressing % DVs for nutrients and determining nutrient levels (nutrient content claims specifying nutrient levels) based on the FDA Nutrition Facts label are as follows:

(1) Measuring the amounts of positive nutrients per serving (the serving is obtained from the RACC) of food exaggerates the amounts of positive nutrients for foods containing excessive energy because the amounts of positive nutrients are measured without regarding the energy amounts of foods. Since consuming foods containing excessive energy is

associated with receiving a significant portion of the DVs for energy per eating occasion, achieving the DVs for positive nutrients by consuming these foods can result in exceeding the DVs for energy, which can lead to obesity or overweight. These vulnerabilities of the FDA regulations affect % DVs and specified levels (high and source claims) for positive nutrients in foods containing excessive energy. For example, consuming hotcakes and sausage (NDB number 21364) per RACC meets 15.28% of the DV for iron. So, the food item of hotcakes and sausage is a source (good source) of iron based on the FDA regulations. Since consuming hotcakes and sausage per RACC is associated with receiving a significant portion of the DV for energy per eating occasion (28.67% of the DV for energy per RACC), achieving the DV for iron by consuming this food results in receiving 187.7% of the DV for energy. In addition, consuming hotcakes and sausage as much as the DV for energy results in receiving 53.3% of the DV for iron. Thus, despite having 15.28% of the DV for iron per RACC, the food item of hotcakes and sausage is unsuitable for achieving the DV for iron due to its excessive energy.

(2) Measuring the amounts of negative nutrients per serving (the serving is obtained from the RACC) of food understates the amounts of negative nutrients for small serving foods. Since exceeding the serving can easily occur for small serving foods, measuring the amounts of negative nutrients in small servings understates the amounts of negative nutrients, and excessive intakes of negative nutrients can increase the risk of certain diet-associated chronic diseases. These vulnerabilities of the FDA regulations affect % DVs for negative nutrients, free claims for negative nutrients, and the low claim for saturated fat in small serving foods. For example, cooking spray oil (NDB number 4679) is introduced as free of fat based on the FDA regulations because the fat amount of this food is 0.197 g per RACC (0.25% of the DV for fat). About 78.7% of the cooking spray oil is composed of fat, but since the RACC of this food is small (0.25 g), this food is introduced as free of fat based on the FDA regulations. However, if the fat amount of cooking spray oil is measured in a suitable amount, it is not introduced as free of fat or low in fat.

(3) Measuring the amounts of negative nutrients per 50 g of food exaggerates the amounts of negative nutrients for small serving foods (small RACC foods). Since measuring the amounts of negative nutrients per serving understates the amounts of negative nutrients for small serving foods, low claims based on the FDA regulations for most negative nutrients are determined per 50 g for small serving foods. However, the definition of small serving (small RACC) based on the FDA regulations is associated with some shortcomings, and the amount of 50 g is large for small serving foods. These vulnerabilities of the FDA regulations affect low claims for energy (calories), cholesterol, fat, and sodium and the very low claim for sodium in small serving foods as they are determined per 50 g of food. For example, dried spearmint (NDB number 2066) is introduced as free of sodium based on the FDA regulations because the sodium amount of this food is 0.344 mg per RACC (0.344 mg of sodium per 0.1 g). Since very low and low claims for sodium based on the FDA regulations are determined per 50 g for small serving foods and dried spearmint contains 172 mg of sodium per 50 g, this food is not introduced as very low or low in sodium based on the FDA regulations. However, if the sodium amount of dried spearmint is measured in a suitable amount, it is only introduced as low in sodium.

(4) Measuring the amounts of negative nutrients per 100 g of food unrealistically understates the amounts of negative nutrients for meals and main dishes because meals and main dishes are customarily consumed more than 100 g per eating occasion. These vulnerabilities of the FDA regulations affect low claims for energy (calories), cholesterol, fat, sodium, and saturated fat and the very low claim for sodium in meals and main dishes as they are determined per 100 g of food. For example, chili with beans (NDB number 16059; main dish product) contains 17 mg of cholesterol and 1.133 g of saturated fat per 100 g. So, it is introduced as low in cholesterol based on the FDA regulations (the low claim for cholesterol based on the FDA regulations is determined per 100 g for meals and main dishes). However, since the food item of chili with beans is customarily consumed 256 g per eating occasion and contains 43.52 mg of cholesterol (14.5% of the DV for cholesterol) and 2.9 g of saturated fat (14.5% of the DV for saturated fat) per RACC, it should not be introduced as low in cholesterol.

(5) The amounts of negative nutrients in free, very low, and low claims based on the FDA regulations are high for some negative nutrients or foods and low for some negative nutrients or foods. Also, the percent of energy (calories) from saturated fat or fat is not considered or is unsuitable in free and low claims for fat and saturated fat based on the FDA regulations. These vulnerabilities of the FDA regulations affect free, very low, and low claims for energy

(calories), cholesterol, fat, sodium, and saturated fat. For example, the food item of crushed tomatoes (NDB number 11693; canned) containing 41.6 calories per RACC is not introduced as low in energy (calories) based on the FDA regulations because the energy (calorie) amount of the low energy claim (low calorie claim) is low in all foods except meals and main dishes (40 calories or less per RACC). But, the food item of beef ravioli in meat sauce (NDB number 22939; main dish product) containing 267.1 calories per RACC (106 calories per 100 g) is introduced as low in energy (calories) based on the FDA regulations because the energy (calorie) amount of the low energy claim is high in meals and main dishes, and this claim is determined per 100 g of food (120 calories or less per 100 g). However, if the energy (calorie) amount of the low energy claim is suitably defined and this claim is determined in a suitable amount of food, the food item of crushed tomatoes is introduced as low in energy (calories), but the food item of beef ravioli in meat sauce is not introduced as low in energy (calories). For example, the fat free claim based on the FDA regulations is defined as less than 0.5 g of fat per RACC or serving of food, and the saturated fat free claim based on the FDA regulations is defined as less than 0.5 g of saturated fat and less than 0.5 g of *trans* fat per RACC or serving of food. Although the DV for fat is 3.9 times greater than the DV for saturated fat (the DV for fat is 78 g and the DV for saturated fat is 20 g), the amount of fat and the amount of saturated fat in both free claims are the same (less than 0.5 g). However, if these two claims are defined correctly, the amount of saturated fat in the saturated fat free claim should be 3.9 times less than the amount of fat in the fat free claim.

(6) The FDA regulations help consumers choose some foods high in total sugars. The FDA Nutrition Facts label contains a % DV for added sugars but does not contain a % DV for total sugars. Also, the FDA regulations include the free claim for added sugars but no claims for total sugars. It would under-represent the sugars amount of foods high in naturally occurring sugars, thus misleading consumers who may need to be aware of total sugars, such as individuals with diabetes, those trying to control their weight, or parents trying to limit children's sugars intake (IOM, 2010). For example, 100 percent fruit juice contains naturally occurring sugars but can easily be over-consumed and contribute to energy imbalance; thus, it has been recommended that such juices be consumed in moderation (AAP, 2001).

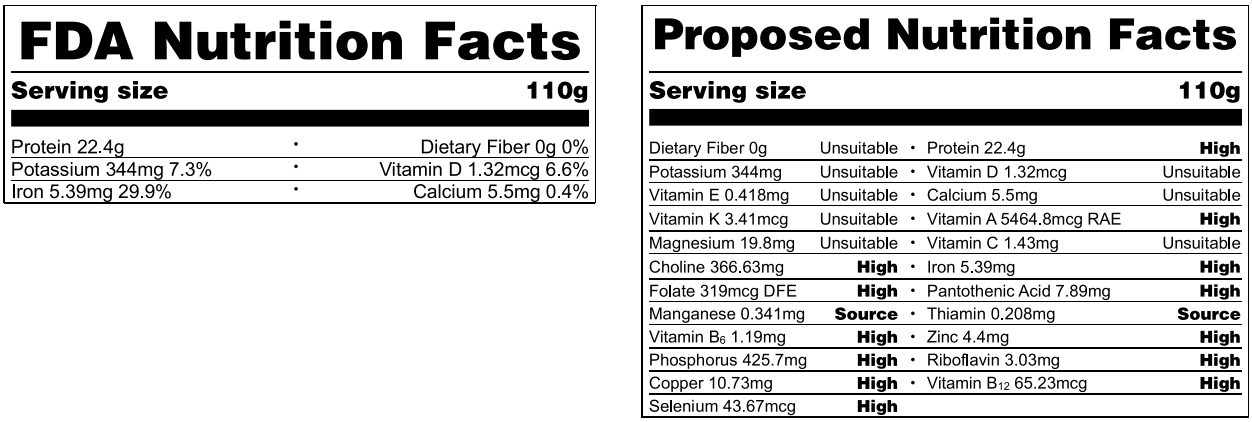
Vulnerabilities of inclusion of positive nutrients on the FDA Nutrition Facts label

Among positive nutrients, the FDA Nutrition Facts label only requires information on dietary fiber, protein, vitamin D, calcium, iron, and potassium. Additional nutrients must be listed when they are added to a food or when specific claims are made about them (IOM, 2010). According to the FDA Nutrition Facts label, the inclusion of positive nutrients (except for six positive nutrients) on the nutrition label is voluntary when they occur naturally within foods, but the inclusion of positive nutrients on the nutrition label is mandatory when they are added to foods. Thus, the FDA Nutrition Facts label promotes fortified foods by mandatory listing positive nutrients that are added to foods and degrades unfortified foods by voluntarily listing positive nutrients (except for six positive nutrients) that occur naturally within foods.

Achieving adequate intakes of potassium, vitamin D, vitamin E, calcium, vitamin K, vitamin A, magnesium, vitamin C, and dietary fiber is difficult, and achieving adequate intakes of choline, iron, and folate is relatively difficult because there are not many foods that contain suitable amounts of these nutrients (Forouzesh et al., 2024). Thus, the lack of making informed food choices may result in inadequate intake of these nutrients in the general population. Among positive nutrients that may result in inadequate intakes in the general population, vitamin E, vitamin K, vitamin A, magnesium, vitamin C, choline, and folate are not listed on the FDA Nutrition Facts label. A national survey in the United States revealed a high prevalence of deficiencies in several micronutrients (Wallace et al., 2014). Specifically, 94.3% of the U.S. population fails to meet the daily requirement for vitamin D, 88.5% for vitamin E, 52.2% for magnesium, 44.1% for calcium, 43.0% for vitamin A, and 38.9% for vitamin C (Wallace et al., 2014). Additionally, the entire population has intake levels below the adequate intake for potassium, 91.7% fall short for choline, and 66.9% for vitamin K (Wallace et al., 2014). Freedman et al. (2024), using 15 years of NHANES data, corroborate these findings, indicating that U.S. adults commonly underconsume potassium, vitamin D, vitamin E, calcium, vitamin K, vitamin A, magnesium, vitamin C, dietary fiber, and choline (Fulgoni et al., 2011; HHS & USDA, 2015).

The need or want to monitor intakes of positive nutrients may vary from person to person (e.g., monitoring vitamin E intake). Thus, the voluntary inclusion of many positive nutrients on the FDA Nutrition Facts label eliminates the ability of consumers to monitor their intake of many positive nutrients and to identify and compare foods in terms of many positive nutrients.

Mandatory inclusion of only six positive nutrients on the FDA Nutrition Facts label can discourage consumers



FDA Nutrition Facts

Serving size **110g**

Protein 22.4g	•	Dietary Fiber 0g 0%	
Potassium 344mg 7.3%	•	Vitamin D 1.32mcg 6.6%	
Iron 5.39mg 29.9%	•	Calcium 5.5mg 0.4%	

Proposed Nutrition Facts

Serving size **110g**

Dietary Fiber 0g	Unsuitable	•	Protein 22.4g	**High**
Potassium 344mg	Unsuitable	•	Vitamin D 1.32mcg	Unsuitable
Vitamin E 0.418mg	Unsuitable	•	Calcium 5.5mg	Unsuitable
Vitamin K 3.41mcg	Unsuitable	•	Vitamin A 5464.8mcg RAE	**High**
Magnesium 19.8mg	Unsuitable	•	Vitamin C 1.43mg	Unsuitable
Choline 366.63mg	**High**	•	Iron 5.39mg	**High**
Folate 319mcg DFE	**High**	•	Pantothenic Acid 7.89mg	**High**
Manganese 0.341mg	**Source**	•	Thiamin 0.208mg	**Source**
Vitamin B_6 1.19mg	**High**	•	Zinc 4.4mg	**High**
Phosphorus 425.7mg	**High**	•	Riboflavin 3.03mg	**High**
Copper 10.73mg	**High**	•	Vitamin B_{12} 65.23mcg	**High**
Selenium 43.67mcg	**High**			

Fig. 3 Comparison of part of the FDA Nutrition Facts label with part of the proposed Nutrition Facts label related to positive nutrients for raw beef liver

from choosing nutritious foods that contain significant amounts of few numbers of these six positive nutrients. For example, Fig. 3 shows part of the FDA Nutrition Facts label and the proposed Nutrition Facts label related to positive nutrients for raw beef liver (NDB number 13325). The proposed Nutrition Facts label tells consumers that raw beef liver is high in vitamin B_{12}, copper, vitamin A, riboflavin, pantothenic acid, folate, selenium, vitamin B_6, choline, protein, zinc, phosphorus, and iron and a source of thiamin and manganese, but it is unsuitable for achieving the DVs for other positive nutrients. However, the FDA Nutrition Facts label does not reflect raw beef liver as nutritious because raw beef liver only contains significant amounts of two positive nutrients (protein and iron) out of the six positive nutrients on the FDA Nutrition Facts label.

Vulnerabilities of using % DVs for nutrients instead of using specified levels for nutrients on the FDA Nutrition Facts label

The FDA requires % DVs for nutrients listed on the Nutrition Facts label (except for energy/calories, *trans* fat, total sugars, and protein). The % DV tells you how much a nutrient in a serving of food contributes to a daily diet (21CFR101.9, revised as of Dec 22, 2023). The % DV can range from 0% to infinity, and foods with a very high % DV for one or more positive nutrients can catch the attention of consumers. Thus, the FDA's use of % DVs for positive nutrients, in contrast to the use of specified levels for positive nutrients (source and high claims for positive nutrients), can encourage unsuitable or excessive use of fortification by food manufacturers in order to catch the attention of consumers.

Making informed food choices to limit intake of any negative nutrient or to achieve adequate intake of any positive nutrient requires scientific knowledge about nutrients, which is expressed in regulatory requirements in the form of nutrient content claims. Since criteria for a claim may depend on a factor other than the amount of the target nutrient, the use of % DV based on the FDA regulations for making food choices may be misleading. For example, consumers mistakenly identify foods low in cholesterol and high in *trans* fat or saturated fat as foods low in cholesterol because the % DV for cholesterol based on the FDA regulations is determined without regarding the amounts of saturated fat and *trans* fat. The impact of dietary cholesterol on LDL (low-density lipoprotein) cholesterol levels is relatively minor compared to the effects of saturated and *trans* fatty acids, given current U.S. intake levels (Clarke et al., 1997; Howell et al., 1997). For example, consumers mistakenly identify some small serving foods high in negative nutrients as foods low in negative nutrients because the % DVs for negative nutrients of those foods are determined in small servings based on the FDA regulations. For example, consumers mistakenly identify some foods low in positive nutrients, which contain excessive energy, as foods high in positive nutrients because the % DVs for positive nutrients of those foods are determined without regarding the energy amounts of foods based on the FDA regulations.

Using specified levels for nutrients rather than % DVs for nutrients is a more effective approach to help consumers make informed food choices. Consumers are likely unaware of the specific nutrient amounts required for nutrient content claims, which can make it challenging for them to compare and make informed decisions about products without considering these claims (IOM, 2010). Use of nutrient content claims specifying nutrient levels is not mandatory on the

FDA Nutrition Facts label. The FDA Nutrition Facts label makes food choices difficult and time-consuming due to the voluntary inclusion of nutrient levels (free, very low, low, source, and high claims for nutrients), which can result in making uninformed food choices or decreased use of the nutrition label.

The claims of free, very low, and low are used to limit intake of any negative nutrient, and the claims of high (excellent source) and source (good source) are used to achieve adequate intake of any positive nutrient (Forouzesh et al., 2024). Since negative nutrients should be limited in the diet and positive nutrients should be encouraged in the diet, specifying high and source levels for negative nutrients and specifying free, very low, and low levels for positive nutrients on nutrition labels that do not contain few numbers of nutrients are harmful. Specifying high and source levels for negative nutrients can decrease attention from limiting intakes of negative nutrients, and specifying free, very low, and low levels for positive nutrients can decrease attention from achieving adequate intakes of positive nutrients. Specified levels for nutrients based on the proposed Nutrition Facts label provide accurate and quick interpretation of nutrient information, thereby encouraging consumers to make informed food choices. However, specified levels for nutrients based on the FDA regulations, as shown earlier, are associated with many vulnerabilities that must be modified prior to use.

For example, Fig. 4 shows the FDA Nutrition Facts label and part of the proposed Nutrition Facts label for macaroni and cheese (prepared with 2% milk and 80% stick margarine; NDB number 22960; main dish product). The proposed Nutrition Facts label tells consumers that the food item of macaroni and cheese is high in folate and selenium and a source of thiamin, riboflavin, manganese, and protein but is unsuitable in other nutrients (to limit intake of any negative nutrient and to achieve adequate intake of any positive nutrient). Since excessive intake of cholesterol and saturated fat can increase the risk of elevated blood LDL cholesterol concentrations, the cholesterol level of the macaroni and cheese is indicated as unsuitable on the proposed Nutrition Facts label due to a significant amount of saturated fat. The food item of macaroni and cheese is low in cholesterol based on the FDA regulations. However, consuming 20 servings of macaroni and cheese results in receiving 360% of the DV for saturated fat. So, the food item of macaroni and cheese is not low in cholesterol based on the proposed Nutrition Facts label. The food item of macaroni and cheese contains a significant amount of *trans* fat. *Trans*

FDA Nutrition Facts

Serving size	**1 cup (198g)**
Amount per serving	
Calories	**376.2**
	% Daily Value*
Total Fat 16.4g	**21%**
Saturated Fat 3.6g	**18%**
Trans Fat 2.45g	
Cholesterol 6mg	**2%**
Sodium 669mg	**29.1%**
Total Carbohydrate 47.4g	**17.2%**
Dietary Fiber 2.38g	**8.5%**
Total Sugars 8.5g	
Includes 0g Added Sugars	**0%**
Protein 9.7g	

Calcium 124.7mg 9.6%	•	Iron 1.96mg 10.9%
Potassium 255.4mg 5.4%	•	Vitamin K 12.7mcg 10.6%
Magnesium 33.7mg 8%	•	Choline 53.3mg 9.7%
Folate 225.7mcg DFE 56.4%	•	Pantothenic Acid 0.855mg 17.1%
Manganese 0.467mg 20.3%	•	Thiamin 0.35mg 29.2%
Vitamin B_6 0.121mg 7.1%	•	Zinc 0.93mg 8.5%
Phosphorus 221.8mg 17.7%	•	Riboflavin 0.352mg 27.1%
Copper 0.147mg 16.3%	•	Vitamin B_{12} 0.317mcg 13.2%
Selenium 24.75mcg 45%	•	

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Proposed Nutrition Facts

Serving size	**1 cup (198g)**
Amount/serving	**Level***
Calories 376.2	Excessive
Total Fat 16.4g	Unsuitable
Saturated Fat 3.6g	Unsuitable
Trans Fat 2.45g	
Cholesterol 6mg	Unsuitable
Sodium 699mg	Unsuitable
Total Carbohydrate 47.4g	
Dietary Fiber 2.38g	Unsuitable
Total Sugars 8.5g	Unsuitable
Includes 0g Added Sugars	
Protein 9.7g	**Source**

Potassium 255.4mg	Unsuitable	•	Calcium 124.7mg	Unsuitable
Vitamin K 12.7mcg	Unsuitable	•	Magnesium 33.7mg	Unsuitable
Choline 53.3mg	Unsuitable	•	Iron 1.96mg	Unsuitable
Folate 225.7mcg DFE	**High**	•	Pantothenic Acid 0.855mg	Unsuitable
Manganese 0.467mg	**Source**	•	Thiamin 0.35mg	**Source**
Vitamin B_6 0.121mg	Unsuitable	•	Zinc 0.93mg	Unsuitable
Phosphorus 221.8mg	Unsuitable	•	Riboflavin 0.352mg	**Source**
Copper 0.147mg	Unsuitable	•	Vitamin B_{12} 0.317mcg	Unsuitable
Selenium 24.75mcg	**High**	•		

* Free, very low, and low levels are used to limit intake of any negative nutrient, and high (excellent source) and source (good source) levels are used to achieve adequate intake of any positive nutrient. If the amount of any nutrient is unsuitable, "unsuitable" is inserted instead of the nutrient level. Also, if the amount of calories is excessive, "excessive" is inserted instead of the calorie level.

Fig. 4 Comparison of the FDA Nutrition Facts label with part of the proposed Nutrition Facts label for macaroni and cheese (prepared with 2% milk and 80% stick margarine)

fats raise LDL-cholesterol concentrations nearly as much as cholesterol-raising saturated fats (NCEP, 1994). Foods containing *trans* fat also contain saturated fat. Thus, the criteria of free and low claims for cholesterol and saturated fat in the proposed Nutrition Facts label are such that foods containing significant amounts of *trans* fat cannot meet the criteria of free and low claims for cholesterol and saturated fat due to their saturated fat amounts. The food item of macaroni and cheese is a source of vitamin K, iron, vitamin B_{12}, copper, pantothenic acid, and phosphorus and high in manganese, riboflavin, and thiamin based on the FDA regulations. However, consuming macaroni and cheese as much as the DV for energy (based on the reference energy intake of 2,000 calories) results in receiving 56.3% of the DV for vitamin K, 57.9% of the DV for iron, 70.2% of the DV for vitamin B_{12}, 86.8% of the DV for copper, 90.9% of the DV for pantothenic acid, and 94.3% of the DV for phosphorus. So, the food item of macaroni and cheese is unsuitable for achieving the DVs for vitamin K, iron, vitamin B_{12}, copper, pantothenic acid, and phosphorus based on the proposed Nutrition Facts label. Also, consuming macaroni and cheese as much as half the DV for energy (1,000 calories) does not result in receiving the DVs for manganese, riboflavin, and thiamin, but consuming macaroni and cheese as much as the DV for energy (2,000 calories) results in receiving the DVs for manganese, riboflavin, and thiamin. According to the proposed Nutrition Facts label, the food item of macaroni and cheese is not high in manganese, riboflavin, and thiamin, but it is a source of these three positive nutrients.

Lack of nutritional quality scores or symbols on the FDA Nutrition Facts label

The assessment of a food by considering the amounts of various nutrients that should be either encouraged or limited is called nutritional quality or nutritional value. The nutritional quality score or symbol provides summary information about the amounts of many different nutrients for a given food in a simple and quick way. Nutritional quality scores or symbols serve as a crucial policy tool for countries, assisting consumers in making healthier food choices (WHO, 2019). The FDA Nutrition Facts label makes food choices difficult and time-consuming due to the lack of nutritional quality scores or symbols, which can result in making uninformed food choices or decreased use of the nutrition label. The proposed Nutrition Facts label provides three numeric scores from 0 to 100 to show the nutritional quality of each food from the three aspects of negative nutrients, positive nutrients, and a combination of positive and negative nutrients. A higher score is preferred to a lower score. For example, Fig. 5 shows the FDA Nutrition Facts label and nutritional quality scores on the proposed Nutrition Facts label for pumpkin pie (commercially prepared; NDB number 18326) and raw blackberries (NDB number 9042). According to the proposed Nutrition Facts label, the nutritional quality score based on negative nutrients, the nutritional quality score based on positive nutrients, and the nutritional quality score based on the combination of positive and negative nutrients for raw blackberries are higher than those scores for pumpkin pie. According to the proposed Nutrition Facts label, the food item of raw blackberries is a better food choice than pumpkin pie. The FDA Nutrition Facts label cannot help consumers choose between these two foods due to the lack of nutritional quality scores or symbols.

Discussion

The proposed Nutrition Facts label includes the amount and level for any nutrient (*trans* fat, total carbohydrate, and added sugars do not have a level). Nutrient levels on the proposed Nutrition Facts label provide accurate and quick interpretation of information for the target nutrient by considering the amount of the target nutrient and other factors affecting the target nutrient in the context of a daily diet. Foods that meet the claim of free, very low, or low for a negative nutrient are known as foods containing suitable levels of negative nutrients (to limit intake of any negative nutrient) (Forouzesh et al., 2024). Also, foods that meet the claim of high or source for a positive nutrient are known as foods containing suitable levels of positive nutrients (to achieve adequate intake of any positive nutrient) (Forouzesh et al., 2024). The amounts of nutrients per serving on the proposed Nutrition Facts label are used to monitor intakes of nutrients. Nutrient levels on the proposed Nutrition Facts label are used to interpret information for individual nutrients in the context of a daily diet and to identify and compare foods in terms of any nutrient.

The FDA Nutrition Facts label lists the amount and the % DV for any nutrient (energy/calories, *trans* fat, total sugars, and protein do not have a % DV). Research shows that consumers find it easier to interpret nutrition information from labels that use text and color to indicate nutrient levels, compared to those that present only numeric information like % DVs (Borgmeier & Westenhoefer, 2009; Gorton et al., 2009; Hersey et al., 2013; Jones & Richardson, 2007; Kelly et al., 2009). Use of nutrient content claims specifying nutrient levels is not mandatory on the FDA Nutrition Facts label. Making informed food choices to limit intake of any negative nutrient or to achieve adequate intake of any positive nutrient requires scientific knowledge about nutrients, which is expressed in regulatory requirements in the form of nutrient content claims. Since criteria for a claim may depend on a

Pumpkin Pie (commercially prepared)

FDA Nutrition Facts

Serving size	**125g**
Amount per serving	
Calories	**304**
	% Daily Value*
Total Fat 12.2g	**15.6%**
Saturated Fat 2.48g	**12.4%**
Trans Fat	
Cholesterol 32.5mg	**10.8%**
Sodium 299mg	**13%**
Total Carbohydrate 43.5g	**15.8%**
Dietary Fiber 2.25g	**8%**
Total Sugars 23.6g	
Added Sugars	
Protein 4.48g	

Vitamin D 0.12mcg 0.6%	•	Calcium 80mg 6.2%
Iron 1.13mg 6.3%	•	Potassium 208.8mg 4.4%
Vitamin E 0.95mg 6.3%	•	Vitamin K 16.5mcg 13.8%
Vitamin A 560mcg RAE 62.2%	•	Magnesium 17.5mg 4.2%
Vitamin C 0mg 0%	•	Choline 46.9mg 8.5%
Folate 46.3mcg DFE 11.6%	•	Pantothenic Acid 0.565mg 11.3%
Manganese 0.284mg 12.3%	•	Thiamin 0.221mg 18.4%
Vitamin B_6 0.079mg 4.6%	•	Zinc 0.487mg 4.4%
Phosphorus 101.3mg 8.1%	•	Riboflavin 0.155mg 11.9%
Copper 0.185mg 20.6%	•	Vitamin B_{12} 0.437mcg 18.2%
Selenium 6.75mcg 12.3%	•	

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Raw Blackberries

FDA Nutrition Facts

Serving size	**140g**
Amount per serving	
Calories	**60**
	% Daily Value*
Total Fat 0.69g	**0.9%**
Saturated Fat 0.02g	**0.1%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 1.4mg	**0.1%**
Total Carbohydrate 13.5g	**4.9%**
Dietary Fiber 7.42g	**26.5%**
Total Sugars 6.8g	
Includes 0g Added Sugars	**0%**
Protein 1.95g	

Vitamin D 0mcg 0%	•	Calcium 40.6mg 3.1%
Iron 0.87mg 4.8%	•	Potassium 226.8mg 4.8%
Vitamin E 1.64mg 10.9%	•	Vitamin K 27.7mcg 23.1%
Vitamin A 15.4mcg RAE 1.7%	•	Magnesium 28mg 6.7%
Vitamin C 29.4mg 32.7%	•	Choline 11.9mg 2.2%
Folate 35mcg DFE 8.8%	•	Pantothenic Acid 0.386mg 7.7%
Manganese 0.904mg 39.3%	•	Thiamin 0.028mg 2.3%
Vitamin B_6 0.042mg 2.5%	•	Zinc 0.74mg 6.7%
Phosphorus 30.8mg 2.5%	•	Riboflavin 0.036mg 2.8%
Copper 0.231mg 25.7%	•	Vitamin B_{12} 0mcg 0%
Selenium 0.56mcg 1%	•	

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Pumpkin Pie (commercially prepared)

Proposed Nutrition Facts

Serving size	**125g**

Scores for nutritional quality based on*

Negative Nutrients **0** Positive & Negative Nutrients **9** Positive Nutrients **11**

* Each food contains three numeric scores from 0 to 100 to show the nutritional quality from the three aspects of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients. A higher score is preferred to a lower score.

Raw Blackberries

Proposed Nutrition Facts

Serving size	**140g**

Scores for nutritional quality based on*

Negative Nutrients **67** Positive & Negative Nutrients **33** Positive Nutrients **24**

* Each food contains three numeric scores from 0 to 100 to show the nutritional quality from the three aspects of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients. A higher score is preferred to a lower score.

Fig. 5 Comparison of pumpkin pie (commercially prepared) with raw blackberries based on the FDA Nutrition Facts label and nutritional quality scores on the proposed Nutrition Facts label

factor other than the amount of the target nutrient, the use of % DV based on the FDA regulations for making food choices may be misleading. For example, claims for cholesterol should be determined by considering the amounts of cholesterol, *trans* fat, and saturated fat because excessive intakes of them can increase the risk of elevated blood LDL cholesterol concentrations. Thus, making food choices based solely on the lower percent of DVs for cholesterol when the amounts of saturated fat or *trans* fat for foods are significant can increase LDL cholesterol concentrations. For example, making food choices based solely on the higher percent of DVs for positive nutrients when the energy amounts of foods are excessive helps consumers choose some foods containing excessive energy due to exaggeration in DVs for positive nutrients, which can lead to obesity or overweight.

Since levels of positive nutrients on the proposed Nutrition Facts label are determined by considering RACCs and energy amounts of foods, specified levels for positive nutrients of foods are not exaggerated on the proposed Nutrition Facts label. For example, Fig. 6 shows information on five positive nutrients from the FDA

Raw Coconut Milk

FDA Nutrition Facts

Serving size	1 cup (240mL)
Amount per serving	
Calories	**560**
	% Daily Value
Dietary Fiber 5.36g	19.1%
Potassium 640.3mg	13.6%
Iron 3.99mg	22.2%
Phosphorus 243.46mg	19.5%
Selenium 15.09mcg	27.4%

High in selenium and iron and a source of phosphorus, dietary fiber, and potassium.

Chili Beef Soup (condensed)

FDA Nutrition Facts

Serving size	1/2 cup (131.5g)
Amount per serving	
Calories	**154**
	% Daily Value
Dietary Fiber 3.29g	11.8%
Potassium 526mg	11.2%
Iron 2.13mg	11.8%
Phosphorus 148.6mg	11.9%
Selenium 6.58mcg	12%

A source of selenium, phosphorus, dietary fiber, iron, and potassium.

Raw Coconut Milk

Proposed Nutrition Facts

Serving size	1 cup (240mL)
Amount/serving	**Level**
Calories 560	Excessive
Dietary Fiber 5.36g	Unsuitable
Potassium 640.3mg	Unsuitable
Iron 3.99mg	Unsuitable
Phosphorus 243.46mg	Unsuitable
Selenium 15.09mcg	Unsuitable

Chili Beef Soup (condensed)

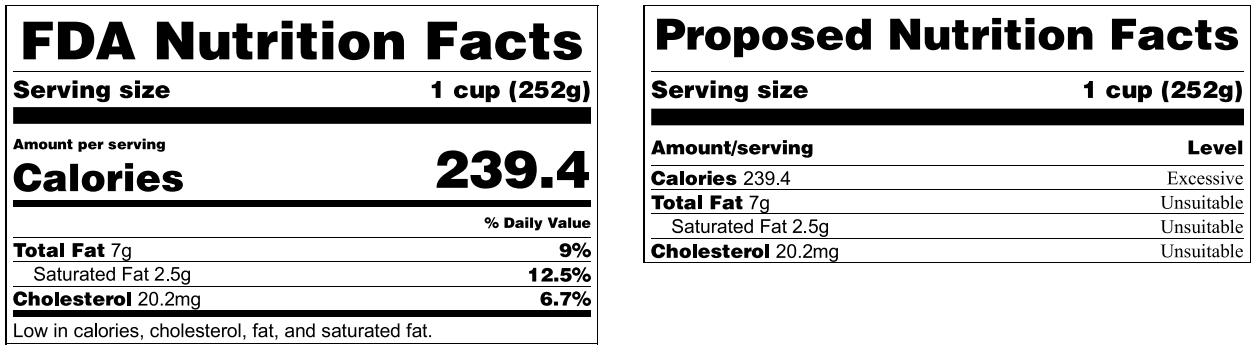
Proposed Nutrition Facts

Serving size	1/2 cup (131.5g)
Amount/serving	**Level**
Calories 154	Unsuitable
Dietary Fiber 3.29g	**Source**
Potassium 526mg	**Source**
Iron 2.13mg	**Source**
Phosphorus 148.6mg	**Source**
Selenium 6.58mcg	**Source**

Fig. 6 Comparison of raw coconut milk with chili beef soup (condensed) in terms of dietary fiber, potassium, iron, phosphorus, and selenium based on the FDA Nutrition Facts label and the proposed Nutrition Facts label

Nutrition Facts label and the proposed Nutrition Facts label for raw coconut milk (NDB number 12117) and chili beef soup (NDB number 6026; condensed). According to the FDA Nutrition Facts label, raw coconut milk is a better food choice than chili beef soup in terms of selenium, iron, phosphorus, dietary fiber, and potassium. Raw coconut milk is high in selenium and iron and a source of phosphorus, dietary fiber, and potassium based on the FDA Nutrition Facts label. However, consuming raw coconut milk as much as the DV for energy (based on the reference energy intake of 2,000 calories) results in receiving 98% of the DV for selenium, 79.2% of the DV for iron, 69.6% of the DV for phosphorus, 68.3% of the DV for dietary fiber, and 48.7% of the DV for potassium. So, raw coconut milk is unsuitable for achieving the DVs for selenium, iron, phosphorus, dietary fiber, and potassium based on the proposed Nutrition Facts label. Chili beef soup is a source of selenium, phosphorus, dietary fiber, iron, and potassium based on the proposed Nutrition Facts label. According to the proposed Nutrition Facts label, chili beef soup is a better food choice than raw coconut milk in terms of these five positive nutrients.

Levels of negative nutrients on the proposed Nutrition Facts label are determined by considering RACCs, DVs, small RACCs, and the number of daily servings. So, the proposed Nutrition Facts label properly indicates specified levels for negative nutrients in foods. For example, Fig. 7 shows information on four negative nutrients from the FDA Nutrition Facts label and the proposed Nutrition Facts label for pasta with meatballs (NDB number 22940; main dish product). Amounts of energy (calories), cholesterol, fat, and saturated fat on the FDA Nutrition Facts label are measured per serving (the serving is obtained from the RACC) for meals and main dishes, but low claims for negative nutrients based on the FDA regulations are determined per 100 g for meals and main dishes. Thus, despite having significant amounts of energy (calories), cholesterol, fat, and saturated fat on the FDA Nutrition Facts label, the food item of pasta with meatballs is low in energy (calories), cholesterol, fat, and saturated fat based on the FDA regulations. The food item of pasta with meatballs is customarily consumed 252 g per eating occasion. So, measuring the amounts of negative nutrients for pasta with meatballs per 100



FDA Nutrition Facts

Serving size	1 cup (252g)
Amount per serving	
Calories	**239.4**
	% Daily Value
Total Fat 7g	**9%**
Saturated Fat 2.5g	**12.5%**
Cholesterol 20.2mg	**6.7%**

Low in calories, cholesterol, fat, and saturated fat.

Proposed Nutrition Facts

Serving size	1 cup (252g)
Amount/serving	**Level**
Calories 239.4	Excessive
Total Fat 7g	Unsuitable
Saturated Fat 2.5g	Unsuitable
Cholesterol 20.2mg	Unsuitable

Fig. 7 Comparison of the FDA Nutrition Facts label with the proposed Nutrition Facts label in terms of energy (calories), cholesterol, fat, and saturated fat for pasta with meatballs

g shows the amounts of negative nutrients of this food unrealistically 2.52 times lower. Consuming 20 servings of pasta with meatballs results in receiving 250% of the DV for saturated fat, 239% of the DV for energy, 180% of the DV for fat, and 134% of the DV for cholesterol. Thus, the food item of pasta with meatballs is not low in saturated fat, energy (calories), fat, and cholesterol based on the proposed Nutrition Facts label.

The proposed Nutrition Facts label contains nutritional quality scores. These scores can be used to understand the nutritional quality of any food in the context of a daily diet from the three aspects of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients (to achieve adequate intake of any positive nutrient and to limit intake of any negative nutrient) in a summary, simple, and quick way. Also, these scores provide the possibility of comparing the nutritional quality of foods within and across food groups (food categories). A numeric score from 0 to 100 is given to each of the three aspects of the nutritional quality of each food. A higher score is preferred to a lower score. The nutritional quality score based on a combination of positive and negative nutrients does not indicate the nutritional quality based on negative nutrients and the nutritional quality based on positive nutrients separately. So, three scores are considered on the proposed Nutrition Facts label to indicate three aspects of the nutritional quality. The nutritional quality score based on negative nutrients focuses on nutrients that should be limited in the diet to prevent or reduce certain diet-associated chronic diseases. The nutritional quality score based on positive nutrients focuses on nutrients that should be encouraged in the diet to meet nutritional needs in the context of daily energy needs and to prevent or reduce nutritional deficiencies.

A nutrition label including only negative nutrients encourages choosing some nutrient-poor foods, which can result in certain nutritional deficiencies. For example, a nutrition label including only negative nutrients encourages consumers to choose fast-food cola carbonated beverage (NDB number 14400) because the fast-food cola carbonated beverage can be used to limit intakes of many negative nutrients (cholesterol, fat, saturated fat, and sodium). However, the fast-food cola carbonated beverage is unsuitable for achieving adequate intakes of positive nutrients. A nutrition label including only positive nutrients encourages choosing some foods high in negative nutrients, which can lead to certain diet-associated chronic diseases. For example, a nutrition label including only positive nutrients encourages consumers to choose canned chicken liver pâté (NDB number 7053) because the canned chicken liver pâté can be used to achieve the DVs for 11 positive nutrients (high choline, copper source, high folate, high iron, high pantothenic acid, protein source, high riboflavin, high selenium, vitamin A source, high vitamin B_{12}, zinc source). However, the canned chicken liver pâté is unsuitable for limiting intakes of most negative nutrients (energy/calories, cholesterol, fat, saturated fat, and sodium). An ideal nutrition label should contain negative nutrients and positive nutrients because ignoring negative nutrients or positive nutrients has harmful consequences. Making food choices based only on negative nutrients or positive nutrients is an incorrect approach that can result from insufficient knowledge about nutrients and the lack of awareness of the complexity of making food choices. Choosing foods based only on negative nutrients or positive nutrients can result in making uninformed food choices in many cases. Making food choices in some cases, even when considering negative nutrients and positive nutrients, is a challenging process.

The proposed Nutrition Facts label helps individuals who desire to comply with dietary recommendations from health care providers or public health guidance. For example, individuals who need to reduce their

daily sodium intake can consume sodium free, very low sodium, or low sodium foods. For example, individuals who need to meet the daily recommended intake of potassium can consume high potassium or potassium source foods.

The proposed Nutrition Facts label is an accurate, convenient, and quick information tool for making informed food choices to reduce or prevent diet-associated chronic diseases and to meet nutritional needs in the context of daily energy needs.

For example, Fig. 8 shows the FDA Nutrition Facts label and the proposed Nutrition Facts label for grilled veal top round cap off (NDB number 17425) and roasted chicken breast meat (NDB number 5064). According to the proposed Nutrition Facts label, the nutritional quality score based on negative nutrients is the same for these two foods, but the nutritional quality score based on positive nutrients and the nutritional quality score based on the combination of positive and negative nutrients for grilled veal top round cap off are higher than those scores for roasted chicken breast meat. So, according to the proposed Nutrition Facts label, grilled veal top round cap off is a better food choice than roasted chicken breast meat. The FDA Nutrition Facts label cannot help consumers choose between these two foods due to the lack of nutritional quality scores or symbols. Roasted chicken breast meat is not low in fat based on the FDA regulations. Consuming 20 servings of roasted chicken breast meat results in receiving 77.7% of the DV for fat. So, roasted chicken breast meat is low in fat based on the proposed Nutrition Facts label.

For example, Fig. 9 shows the FDA Nutrition Facts label and the proposed Nutrition Facts label for meat and vegetable pizza (regular crust; NDB number 21226) and spinach souffle (NDB number 11658). According to the proposed Nutrition Facts label, the nutritional quality score based on negative nutrients, the nutritional quality score based on positive nutrients, and the nutritional quality score based on the combination of positive and negative nutrients for spinach souffle are higher than those scores for meat and vegetable pizza. So, according to the proposed Nutrition Facts label, spinach souffle is a better food choice than meat and vegetable pizza. The FDA Nutrition Facts label cannot help consumers choose between these two foods due to the lack of nutritional quality scores or symbols. Meat and vegetable pizza is high in copper, phosphorus, protein, riboflavin, selenium, thiamin, vitamin B_{12}, and zinc and a source of calcium, dietary fiber, iron, vitamin A, vitamin B_6, and vitamin E based on the FDA regulations. However, consuming meat and vegetable pizza as much as the DV for energy (based on the reference energy intake of 2,000 calories) results in receiving 53.3% of the DV for vitamin A, 54.5% of the DV for vitamin E, 54.6% of the DV for iron, 56.9% of the DV for dietary fiber, 63.6% of the DV for vitamin B_6, and 84.7% of the DV for calcium. So, meat and vegetable pizza is unsuitable for achieving the DVs for vitamin A, vitamin E, iron, dietary fiber, vitamin B_6, and calcium based on the proposed Nutrition Facts label. Also, consuming meat and vegetable pizza as much as half the DV for energy (1,000 calories) does not result in receiving the DVs for vitamin B_{12}, protein, copper, thiamin, riboflavin, selenium, zinc, and phosphorus, but consuming meat and vegetable pizza as much as the DV for energy (2,000 calories) results in receiving the DVs for these eight positive nutrients. Thus, according to the proposed Nutrition Facts label, meat and vegetable pizza is not high in vitamin B_{12}, protein, copper, thiamin, riboflavin, selenium, zinc, and phosphorus, but it is a source of these eight positive nutrients.

For example, Fig. 10 shows the FDA Nutrition Facts label and the proposed Nutrition Facts label for pasta with sliced franks in tomato sauce (main dish product; NDB number 22522) and dried white beans (NDB number 16049). According to the proposed Nutrition Facts label, the nutritional quality score based on positive nutrients for pasta with sliced franks in tomato sauce is higher than that score for dried white beans, but the nutritional quality score based on negative nutrients and the nutritional quality score based on the combination of positive and negative nutrients for dried white beans are higher than those scores for pasta with sliced franks in tomato sauce. The FDA Nutrition Facts label cannot help consumers choose between these two foods due to the lack of nutritional quality scores or symbols. The food item of dried white beans is not free of sodium based on the FDA regulations. Consuming 200 servings of dried white beans results in receiving 48.7% of the DV for sodium. So, the food item of dried white beans is free of sodium based on the proposed Nutrition Facts label. Pasta with sliced franks in tomato sauce is low in energy (calories), cholesterol, fat, and saturated fat based on the FDA regulations. Consuming 20 servings of pasta with sliced franks in tomato sauce results in receiving 227% of the DV for energy, 200% of the DV for saturated fat, 154% of the DV for fat, and 151% of the DV for cholesterol. So, pasta with sliced franks in tomato sauce is not low in energy (calories), saturated fat, fat, and cholesterol based on the proposed Nutrition Facts label. Pasta with sliced franks in tomato sauce is high in protein and a source of potassium, vitamin C, and vitamin B_6 based on the FDA regulations. However, consuming pasta with sliced franks in tomato sauce as much as the DV for energy (based on the reference energy intake of 2,000 calories) results in receiving 90.3% of the DV for potassium, 93.9% of the DV for vitamin C, and 95.4% of the DV for vitamin B_6.

Grilled Veal Top Round Cap Off

FDA Nutrition Facts

Serving size 85g

Amount per serving

Calories 128

	% Daily Value*
Total Fat 2.24g	**2.9%**
Saturated Fat 0.86g	**4.3%**
Trans Fat 0.097g	
Cholesterol 61.2mg	**20.4%**
Sodium 74.8mg	**3.3%**
Total Carbohydrate 0g	**0%**
Dietary Fiber 0g	**0%**
Total Sugars 0g	
Includes 0g Added Sugars	**0%**
Protein 27.1g	

Vitamin D 0.51mcg 2.6%	•	Calcium 5.1mg 0.4%
Iron 1.18mg 6.6%	•	Potassium 275mg 5.9%
Vitamin E 0.365mg 2.4%	•	Vitamin K 1.1mcg 0.9%
Vitamin A 0mcg RAE 0%	•	Magnesium 32.3mg 7.7%
Vitamin C 0mg 0%	•	Choline 136mg 24.7%
Folate 6.8mcg DFE 1.7%	•	Pantothenic Acid 0.55mg 11%
Manganese 0.014mg 0.6%	•	Thiamin 0.079mg 6.6%
Vitamin B_6 0.647mg 38.1%	•	Zinc 2.8mg 25.5%
Phosphorus 235mg 18.8%	•	Riboflavin 0.399mg 30.7%
Copper 0.095mg 10.6%	•	Vitamin B_{12} 2.31mcg 96.3%
Selenium 18.4mcg 33.5%	•	

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Roasted Chicken Breast Meat

FDA Nutrition Facts

Serving size 85g

Amount per serving

Calories 140

	% Daily Value*
Total Fat 3.03g	**3.9%**
Saturated Fat 0.86g	**4.3%**
Trans Fat	
Cholesterol 72.3mg	**24.1%**
Sodium 62.9mg	**2.7%**
Total Carbohydrate 0g	**0%**
Dietary Fiber 0g	**0%**
Total Sugars 0g	
Includes 0g Added Sugars	**0%**
Protein 26.4g	

Vitamin D 0.085mcg 0.4%	•	Calcium 12.8mg 1%
Iron 0.884mg 0.3%	•	Potassium 217.6mg 4.6%
Vitamin E 0.2295mg 1.5%	•	Vitamin K 0.255mcg 0.2%
Vitamin A 5.1mcg RAE 0.6%	•	Magnesium 24.7mg 5.9%
Vitamin C 0mg 0%	•	Choline 72.5mg 13.2%
Folate 3.4mcg DFE 0.9%	•	Pantothenic Acid 0.82mg 16.4%
Manganese 0.014mg 0.6%	•	Thiamin 0.059mg 5%
Vitamin B_6 0.51mg 30%	•	Zinc 0.85mg 7.7%
Phosphorus 193.8mg 15.5%	•	Riboflavin 0.097mg 7.5%
Copper 0.041mg 4.6%	•	Vitamin B_{12} 0.289mcg 12%
Selenium 23.5mcg 42.7%	•	

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Grilled Veal Top Round Cap Off

Proposed Nutrition Facts

Serving size 85g

Scores for nutritional quality based on*

Negative Nutrients **42** Positive & Negative Nutrients **38** Positive Nutrients **37**

Amount/serving	**Level****
Calories 128	Unsuitable
Total Fat 2.24g	**Low**
Saturated Fat 0.86g	**Low**
Trans Fat 0.097g	
Cholesterol 61.2mg	Unsuitable
Sodium 74.8mg	**Low**
Total Carbohydrate 0g	
Dietary Fiber 0g	Unsuitable
Total Sugars 0g	**Free**
Includes 0g Added Sugars	
Protein 27.1g	**High**

Potassium 275mg	Unsuitable	•	Vitamin D 0.51mcg	Unsuitable
Vitamin E 0.365mg	Unsuitable	•	Calcium 5.1mg	Unsuitable
Vitamin K 1.1mcg	Unsuitable	•	Vitamin A 0mcg RAE	Unsuitable
Magnesium 32.3mg	Unsuitable	•	Vitamin C 0mg	Unsuitable
Choline 136mg	**High**	•	Iron 1.18mg	Unsuitable
Folate 6.8mcg DFE	Unsuitable	•	Pantothenic Acid 0.55mg	**Source**
Manganese 0.014mg	Unsuitable	•	Thiamin 0.079mg	Unsuitable
Vitamin B_6 0.647mg	**High**	•	Zinc 2.8mg	**High**
Phosphorus 235mg	**Source**	•	Riboflavin 0.399mg	**High**
Copper 0.095mg	**Source**	•	Vitamin B_{12} 2.31mcg	**High**
Selenium 18.4mcg	**High**	•		

* Each food contains three numeric scores from 0 to 100 to show the nutritional quality from the three aspects of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients. A higher score is preferred to a lower score.

** Free, very low, and low levels are used to limit intake of any negative nutrient, and high (excellent source) and source (good source) levels are used to achieve adequate intake of any positive nutrient. If the amount of any nutrient is unsuitable, "unsuitable" is inserted instead of the nutrient level. Also, if the amount of calories is excessive, "excessive" is inserted instead of the calorie level.

Roasted Chicken Breast Meat

Proposed Nutrition Facts

Serving size 85g

Scores for nutritional quality based on*

Negative Nutrients **42** Positive & Negative Nutrients **26** Positive Nutrients **22**

Amount/serving	**Level****
Calories 140	Unsuitable
Total Fat 3.03g	**Low**
Saturated Fat 0.86g	**Low**
Trans Fat	
Cholesterol 72.3mg	Unsuitable
Sodium 62.9mg	**Low**
Total Carbohydrate 0g	
Dietary Fiber 0g	Unsuitable
Total Sugars 0g	**Free**
Includes 0g Added Sugars	
Protein 26.4g	**High**

Potassium 217.6mg	Unsuitable	•	Vitamin D 0.085mcg	Unsuitable
Vitamin E 0.2295mg	Unsuitable	•	Calcium 12.8mg	Unsuitable
Vitamin K 0.255mcg	Unsuitable	•	Vitamin A 5.1mcg RAE	Unsuitable
Magnesium 24.7mg	Unsuitable	•	Vitamin C 0mg	Unsuitable
Choline 72.5mg	**Source**	•	Iron 0.884mg	Unsuitable
Folate 3.4mcg DFE	Unsuitable	•	Pantothenic Acid 0.82mg	**Source**
Manganese 0.014mg	Unsuitable	•	Thiamin 0.059mg	Unsuitable
Vitamin B_6 0.51mg	**High**	•	Zinc 0.85mg	Unsuitable
Phosphorus 193.8mg	**Source**	•	Riboflavin 0.097mg	Unsuitable
Copper 0.041mg	Unsuitable	•	Vitamin B_{12} 0.289mcg	**Source**
Selenium 23.5mcg	**High**	•		

* Each food contains three numeric scores from 0 to 100 to show the nutritional quality from the three aspects of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients. A higher score is preferred to a lower score.

** Free, very low, and low levels are used to limit intake of any negative nutrient, and high (excellent source) and source (good source) levels are used to achieve adequate intake of any positive nutrient. If the amount of any nutrient is unsuitable, "unsuitable" is inserted instead of the nutrient level. Also, if the amount of calories is excessive, "excessive" is inserted instead of the calorie level.

Fig. 8 Comparison of grilled veal top round cap off with roasted chicken breast meat based on the FDA Nutrition Facts label and the proposed Nutrition Facts label

Meat and Vegetable Pizza (regular crust)

FDA Nutrition Facts

Serving size 140g

Amount per serving

Calories 386.4

	% Daily Value*
Total Fat 20.2g	**26%**
Saturated Fat 7.12g	**35.6%**
Trans Fat	
Cholesterol 22.4mg	**7.5%**
Sodium 777mg	**33.8%**
Total Carbohydrate 35.2g	**12.8%**
Dietary Fiber 3.08g	**11%**
Total Sugars 6.8g	
Added Sugars	
Protein 15.8g	

Vitamin D 0mcg 0%	•	Calcium 212.8mg 16.4%
Iron 1.9mg 10.6%	•	Potassium 292.6mg 6.2%
Vitamin E 1.58mg 10.5%	•	Vitamin K 11.48mcg 9.6%
Vitamin A 91mcg RAE 10.1%	•	Magnesium 35mg 8.3%
Vitamin C 4.76mg 5.3%	•	Choline 34.3mg 6.2%
Folate 79.8mcg DFE 19.9%	•	Pantothenic Acid 0.465mg 9.3%
Manganese 0.452mg 19.7%	•	Thiamin 0.302mg 25.2%
Vitamin B_6 0.209mg 12.3%	•	Zinc 2.394mg 21.8%
Phosphorus 253.4mg 20.3%	•	Riboflavin 0.326mg 25.1%
Copper 0.238mg 26.4%	•	Vitamin B_{12} 0.868mcg 36.2%
Selenium 12.6mcg 22.9%	•	

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Spinach Souffle

FDA Nutrition Facts

Serving size 110g

Amount per serving

Calories 189.2

	% Daily Value*
Total Fat 14.25g	**18.3%**
Saturated Fat 6.7g	**33.5%**
Trans Fat 0.21g	
Cholesterol 129.8mg	**43.3%**
Sodium 622.6mg	**27.1%**
Total Carbohydrate 6.5g	**2.4%**
Dietary Fiber 0.77g	**2.8%**
Total Sugars 2.035g	
Added Sugars	
Protein 8.679g	

Vitamin D 0.88mcg 4.4%	•	Calcium 181.5mg 14%
Iron 1.31mg 7.3%	•	Potassium 254.1mg 5.4%
Vitamin E 1.02mg 6.8%	•	Vitamin K 139.15mcg 116%
Vitamin A 268.4mcg RAE 29.8%	•	Magnesium 33mg 7.9%
Vitamin C 8mg 8.9%	•	Choline 67.1mg 12.2%
Folate 84.7mcg DFE 21.2%	•	Pantothenic Acid 0.482mg 9.6%
Manganese 0.296mg 12.9%	•	Thiamin 0.09mg 7.5%
Vitamin B_6 0.1078mg 6.3%	•	Zinc 0.935mg 8.5%
Phosphorus 152.9mg 12.2%	•	Riboflavin 0.2893mg 22.3%
Copper 0.065mg 7.2%	•	Vitamin B_{12} 0.44mcg 18.3%
Selenium 12.21mcg 22.2%	•	

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Meat and Vegetable Pizza (regular crust)

Proposed Nutrition Facts

Serving size 140g

Scores for nutritional quality based on*

Negative Nutrients **0** Positive & Negative Nutrients **17** Positive Nutrients **22**

Amount/serving	**Level****
Calories 386.4	Excessive
Total Fat 20.2g	Unsuitable
Saturated Fat 7.12g	Unsuitable
Trans Fat	
Cholesterol 22.4mg	Unsuitable
Sodium 777mg	Unsuitable
Total Carbohydrate 35.2g	
Dietary Fiber 3.08g	Unsuitable
Total Sugars 6.8g	Unsuitable
Added Sugars	
Protein 15.8g	**Source**

Potassium 292.6mg	Unsuitable	•	Vitamin D 0mcg	Unsuitable
Vitamin E 1.58mg	Unsuitable	•	Calcium 212.8mg	Unsuitable
Vitamin K 11.48mcg	Unsuitable	•	Vitamin A 91mcg RAE	Unsuitable
Magnesium 35mg	Unsuitable	•	Vitamin C 4.76mg	Unsuitable
Choline 34.3mg	Unsuitable	•	Iron 1.9mg	Unsuitable
Folate 79.8mcg DFE	**Source**	•	Pantothenic Acid 0.465mg	Unsuitable
Manganese 0.452mg	**Source**	•	Thiamin 0.302mg	**Source**
Vitamin B_6 0.209mg	Unsuitable	•	Zinc 2.394mg	**Source**
Phosphorus 253.4mg	**Source**	•	Riboflavin 0.326mg	**Source**
Copper 0.238mg	**Source**	•	Vitamin B_{12} 0.868mcg	**Source**
Selenium 12.6mcg	**Source**	•		

* Each food contains three numeric scores from 0 to 100 to show the nutritional quality from the three aspects of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients. A higher score is preferred to a lower score.

** Free, very low, and low levels are used to limit intake of any negative nutrient, and high (excellent source) and source (good source) levels are used to achieve adequate intake of any positive nutrient. If the amount of any nutrient is unsuitable, "unsuitable" is inserted instead of the nutrient level. Also, if the amount of calories is excessive, "excessive" is inserted instead of the calorie level.

Spinach Souffle

Proposed Nutrition Facts

Serving size 110g

Scores for nutritional quality based on*

Negative Nutrients **8** Positive & Negative Nutrients **29** Positive Nutrients **35**

Amount/serving	**Level****
Calories 189.2	Unsuitable
Total Fat 14.25g	Unsuitable
Saturated Fat 6.7g	Unsuitable
Trans Fat 0.21g	
Cholesterol 129.8mg	Unsuitable
Sodium 622.6mg	Unsuitable
Total Carbohydrate 6.5g	
Dietary Fiber 0.77g	Unsuitable
Total Sugars 2.035g	**Low**
Added Sugars	
Protein 8.679g	**Source**

Potassium 254.1mg	Unsuitable	•	Vitamin D 0.88mcg	Unsuitable
Vitamin E 1.02mg	Unsuitable	•	Calcium 181.5mg	**Source**
Vitamin K 139.15mcg	**High**	•	Vitamin A 268.4mcg RAE	**High**
Magnesium 33mg	Unsuitable	•	Vitamin C 8mg	Unsuitable
Choline 67.1mg	**Source**	•	Iron 1.31mg	Unsuitable
Folate 84.7mcg DFE	**High**	•	Pantothenic Acid 0.482mg	Unsuitable
Manganese 0.296mg	**Source**	•	Thiamin 0.09mg	Unsuitable
Vitamin B_6 0.1078mg	Unsuitable	•	Zinc 0.935mg	Unsuitable
Phosphorus 152.9mg	**Source**	•	Riboflavin 0.2893mg	**High**
Copper 0.065mg	Unsuitable	•	Vitamin B_{12} 0.44mcg	**Source**
Selenium 12.21mcg	**High**	•		

* Each food contains three numeric scores from 0 to 100 to show the nutritional quality from the three aspects of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients. A higher score is preferred to a lower score.

** Free, very low, and low levels are used to limit intake of any negative nutrient, and high (excellent source) and source (good source) levels are used to achieve adequate intake of any positive nutrient. If the amount of any nutrient is unsuitable, "unsuitable" is inserted instead of the nutrient level. Also, if the amount of calories is excessive, "excessive" is inserted instead of the calorie level.

Fig. 9 Comparison of meat and vegetable pizza (regular crust) with spinach souffle based on the FDA Nutrition Facts label and the proposed Nutrition Facts label

Pasta with Sliced Franks in Tomato Sauce

FDA Nutrition Facts

Serving size **1 cup (252g)**

Amount per serving

Calories **226.8**

	% Daily Value*
Total Fat 6g	**7.7%**
Saturated Fat 2g	**10%**
Trans Fat	
Cholesterol 22.7mg	**7.6%**
Sodium 723.2mg	**31.4%**
Total Carbohydrate 32g	**11.6%**
Dietary Fiber 4.03g	**14.4%**
Total Sugars 8g	
Added Sugars	
Protein 11g	

Vitamin D 1mcg 5%	•	Calcium 151.2mg 11.6%
Iron 2.29mg 12.7%	•	Potassium 481.3mg 10.2%
Vitamin E 1.86mg 12.4%	•	Vitamin K 4.03mcg 3.4%
Vitamin A 32.8mcg RAE 3.6%	•	Magnesium 35.3mg 8.4%
Vitamin C 9.58mg 10.6%	•	Choline 30.2mg 5.5%
Folate 123.5mcg DFE 30.9%	•	Pantothenic Acid 0.605mg 12.1%
Manganese 0.325mg 14.1%	•	Thiamin 0.197mg 16.4%
Vitamin B_6 0.184mg 10.8%	•	Zinc 1.31mg 11.9%
Phosphorus 108.4mg 8.7%	•	Riboflavin 0.174mg 13.4%
Copper 0.343mg 38.1%	•	Vitamin B_{12} 0.478mcg 19.9%
Selenium 20.2mcg 36.7%	•	

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Dried White Beans

FDA Nutrition Facts

Serving size **35g**

Amount per serving

Calories **117**

	% Daily Value*
Total Fat 0.3g	**0.4%**
Saturated Fat 0.08g	**0.4%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 5.6mg	**0.2%**
Total Carbohydrate 21.1g	**7.7%**
Dietary Fiber 5.3g	**19%**
Total Sugars 0.74g	
Includes 0g Added Sugars	**0%**
Protein 8.2g	

Vitamin D 0mcg 0%	•	Calcium 84mg 6.5%
Iron 3.65mg 20.3%	•	Potassium 628.3mg 13.4%
Vitamin E 0.07mg 0.5%	•	Vitamin K 1.96mcg 1.6%
Vitamin A 0mcg RAE 0%	•	Magnesium 66.5mg 15.8%
Vitamin C 0mg 0%	•	Choline 23.2mg 4.2%
Folate 135.8mcg DFE 34%	•	Pantothenic Acid 0.256mg 5.1%
Manganese 0.629mg 27.3%	•	Thiamin 0.1529mg 12.7%
Vitamin B_6 0.11mg 6.5%	•	Zinc 1.285mg 11.7%
Phosphorus 105.4mg 8.4%	•	Riboflavin 0.051mg 3.9%
Copper 0.3444mg 38.3%	•	Vitamin B_{12} 0mcg 0%
Selenium 4.48mcg 8.1%	•	

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Pasta with Sliced Franks in Tomato Sauce

Proposed Nutrition Facts

Serving size **1 cup (252g)**

Scores for nutritional quality based on*

Negative Nutrients **0** Positive & Negative Nutrients **29** Positive Nutrients **37**

Amount/serving	**Level****
Calories 226.8	Excessive
Total Fat 6g	Unsuitable
Saturated Fat 2g	Unsuitable
Trans Fat	
Cholesterol 22.7mg	Unsuitable
Sodium 723.2mg	Unsuitable
Total Carbohydrate 32g	
Dietary Fiber 4.03g	**Source**
Total Sugars 8g	Unsuitable
Added Sugars	
Protein 11g	**Source**

Potassium 481.3mg	Unsuitable	• Vitamin D 1mcg	Unsuitable
Vitamin E 1.86mg	**Source**	• Calcium 151.2mg	**Source**
Vitamin K 4.03mcg	Unsuitable	• Vitamin A 32.8mcg RAE	Unsuitable
Magnesium 35.3mg	Unsuitable	• Vitamin C 9.58mg	Unsuitable
Choline 30.2mg	Unsuitable	• Iron 2.29mg	**Source**
Folate 123.5mcg DFE	**High**	• Pantothenic Acid 0.605mg	**Source**
Manganese 0.325mg	**Source**	• Thiamin 0.197mg	**Source**
Vitamin B_6 0.184mg	Unsuitable	• Zinc 1.31mg	**Source**
Phosphorus 108.4mg	Unsuitable	• Riboflavin 0.174mg	**Source**
Copper 0.343mg	**High**	• Vitamin B_{12} 0.478mcg	**Source**
Selenium 20.2mcg	**High**	•	

* Each food contains three numeric scores from 0 to 100 to show the nutritional quality from the three aspects of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients. A higher score is preferred to a lower score.

** Free, very low, and low levels are used to limit intake of any negative nutrient, and high (excellent source) and source (good source) levels are used to achieve adequate intake of any positive nutrient. If the amount of any nutrient is unsuitable, "unsuitable" is inserted instead of the nutrient level. Also, if the amount of calories is excessive, "excessive" is inserted instead of the calorie level.

Dried White Beans

Proposed Nutrition Facts

Serving size **35g**

Scores for nutritional quality based on*

Negative Nutrients **75** Positive & Negative Nutrients **40** Positive Nutrients **30**

Amount/serving	**Level****
Calories 117	Unsuitable
Total Fat 0.3g	**Free**
Saturated Fat 0.08g	**Free**
Trans Fat 0g	
Cholesterol 0mg	**Free**
Sodium 5.6mg	**Free**
Total Carbohydrate 21.1g	
Dietary Fiber 5.3g	**Source**
Total Sugars 0.74g	**Low**
Includes 0g Added Sugars	
Protein 8.2g	**Source**

Potassium 628.3mg	**Source**	• Vitamin D 0mcg	Unsuitable
Vitamin E 0.07mg	Unsuitable	• Calcium 84mg	Unsuitable
Vitamin K 1.96mcg	Unsuitable	• Vitamin A 0mcg RAE	Unsuitable
Magnesium 66.5mg	**Source**	• Vitamin C 0mg	Unsuitable
Choline 23.2mg	Unsuitable	• Iron 3.65mg	**High**
Folate 135.8mcg DFE	**High**	• Pantothenic Acid 0.256mg	Unsuitable
Manganese 0.629mg	**High**	• Thiamin 0.1529mg	**Source**
Vitamin B_6 0.11mg	Unsuitable	• Zinc 1.285mg	**Source**
Phosphorus 105.4mg	Unsuitable	• Riboflavin 0.051mg	Unsuitable
Copper 0.3444mg	**High**	• Vitamin B_{12} 0mcg	Unsuitable
Selenium 4.48mcg	Unsuitable	•	

* Each food contains three numeric scores from 0 to 100 to show the nutritional quality from the three aspects of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients. A higher score is preferred to a lower score.

** Free, very low, and low levels are used to limit intake of any negative nutrient, and high (excellent source) and source (good source) levels are used to achieve adequate intake of any positive nutrient. If the amount of any nutrient is unsuitable, "unsuitable" is inserted instead of the nutrient level. Also, if the amount of calories is excessive, "excessive" is inserted instead of the calorie level.

Fig. 10 Comparison of pasta with sliced franks in tomato sauce with dried white beans based on the FDA Nutrition Facts label and the proposed Nutrition Facts label

So, pasta with sliced franks in tomato sauce is unsuitable for achieving the DVs for potassium, vitamin C, and vitamin B_6 based on the proposed Nutrition Facts label. Also, consuming pasta with sliced franks in tomato sauce as much as half the DV for energy (1,000 calories) does not result in receiving the DV for protein, but consuming pasta with sliced franks in tomato sauce as much as the DV for energy (2,000 calories) results in receiving the DV for protein. Thus, according to the proposed Nutrition Facts label, pasta with sliced franks in tomato sauce is not high in protein, but it is a source of protein.

For example, Fig. 11 shows the FDA Nutrition Facts label and the proposed Nutrition Facts label for pumpkin pie (commercially prepared; NDB number 18326) and raw blackberries (NDB number 9042). According to the proposed Nutrition Facts label, the nutritional quality score based on negative nutrients, the nutritional quality score based on positive nutrients, and the nutritional quality score based on the combination of positive and negative nutrients for raw blackberries are higher than those scores for pumpkin pie. So, according to the proposed Nutrition Facts label, the food item of raw blackberries is a better food choice than pumpkin pie. The FDA Nutrition Facts label cannot help consumers choose between these two foods due to the lack of nutritional quality scores or symbols. The food item of raw blackberries is not low in energy (calories) based on the FDA regulations. Consuming 20 servings of raw blackberries results in receiving 60% of the DV for energy. So, the food item of raw blackberries is low in energy (calories) based on the proposed Nutrition Facts label. Pumpkin pie is a source of pantothenic acid, folate, riboflavin, manganese, selenium, and vitamin K and high in copper based on the FDA regulations. However, consuming pumpkin pie as much as the DV for energy (based on the reference energy intake of 2,000 calories) results in receiving 74.3% of the DV for pantothenic acid, 76.2% of the DV for folate, 78.4% of the DV for riboflavin, 81.2% of the DV for manganese, 80.7% of the DV for selenium, and 90.5% of the DV for vitamin K. So, pumpkin pie is unsuitable for achieving the DVs for pantothenic acid, folate, riboflavin, manganese, selenium, and vitamin K based on the proposed Nutrition Facts label. Also, consuming pumpkin pie as much as half the DV for energy (1,000 calories) does not result in receiving the DV for copper, but consuming pumpkin pie as much as the DV for energy (2,000 calories) results in receiving the DV for copper. Thus, according to the proposed Nutrition Facts label, pumpkin pie is not high in copper, but it is a source of copper.

For example, Fig. 12 shows the FDA Nutrition Facts label and the proposed Nutrition Facts label for canned carrot juice (NDB number 11655) and cheeseburger (large patty; with condiments, vegetables and mayonnaise; NDB number 21397). According to the proposed Nutrition Facts label, the nutritional quality score based on negative nutrients, the nutritional quality score based on positive nutrients, and the nutritional quality score based on the combination of positive and negative nutrients for canned carrot juice are higher than those scores for cheeseburger. So, according to the proposed Nutrition Facts label, canned carrot juice is a better food choice than the cheeseburger. The FDA Nutrition Facts label cannot help consumers choose between these two foods due to the lack of nutritional quality scores or symbols. Canned carrot juice is not low in energy (calories) based on the FDA regulations. Consuming 20 servings of canned carrot juice results in receiving 96% of the DV for energy. So, canned carrot juice is low in energy (calories) based on the proposed Nutrition Facts label. Cheeseburger is a source of vitamin A, calcium, choline, manganese, copper, and phosphorus and high in vitamin B_6, vitamin K, iron, thiamin, pantothenic acid, folate, riboflavin, and zinc based on the FDA regulations. However, consuming cheeseburger as much as the DV for energy (based on the reference energy intake of 2,000 calories) results in receiving 41.5% of the DV for vitamin A, 41.9% of the DV for calcium, 49.9% of the DV for choline, 60.4% of the DV for manganese, 67.2% of the DV for copper, 74.6% of the DV for phosphorus, 81.7% of the DV for vitamin B_6, 88.3% of the DV for vitamin K, and 95.5% of the DV for iron. So, cheeseburger is unsuitable for achieving the DVs for vitamin A, calcium, choline, manganese, copper, phosphorus, vitamin B_6, vitamin K, and iron based on the proposed Nutrition Facts label. Also, consuming cheeseburger as much as half the DV for energy (1,000 calories) does not result in receiving the DVs for thiamin, pantothenic acid, folate, riboflavin, and zinc, but consuming cheeseburger as much as the DV for energy (2,000 calories) results in receiving the DVs for these five positive nutrients. Thus, according to the proposed Nutrition Facts label, cheeseburger is not high in thiamin, pantothenic acid, folate, riboflavin, and zinc, but it is a source of these five positive nutrients.

In this article, the proposed Nutrition Facts label is presented by considering some nutrients for which DVs are specified. However, there are more nutrients (Kris-Etherton et al., 2002; Martins, 2015, 2016; Shahidi, 2004) that can affect human health and can be considered for inclusion on the nutrition label once DVs are established for them.

Conclusion

Nutrition labels on packaged foods or on shelf tags are used to help the general population make informed food choices to reduce or prevent diet-associated chronic

Pumpkin Pie (commercially prepared)

FDA Nutrition Facts

Serving size 125g

Amount per serving

Calories 304

	% Daily Value*
Total Fat 12.2g	**15.6%**
Saturated Fat 2.48g	**12.4%**
Trans Fat	
Cholesterol 32.5mg	**10.8%**
Sodium 299mg	**13%**
Total Carbohydrate 43.5g	**15.8%**
Dietary Fiber 2.25g	**8%**
Total Sugars 23.6g	
Added Sugars	
Protein 4.48g	

Vitamin D 0.12mcg 0.6%	•	Calcium 80mg 6.2%
Iron 1.13mg 6.3%	•	Potassium 208.8mg 4.4%
Vitamin E 0.95mg 6.3%	•	Vitamin K 16.5mcg 13.8%
Vitamin A 560mcg RAE 62.2%	•	Magnesium 17.5mg 4.2%
Vitamin C 0mg 0%	•	Choline 46.9mg 8.5%
Folate 46.3mcg DFE 11.6%	•	Pantothenic Acid 0.565mg 11.3%
Manganese 0.284mg 12.3%	•	Thiamin 0.221mg 18.4%
Vitamin B_6 0.079mg 4.6%	•	Zinc 0.487mg 4.4%
Phosphorus 101.3mg 8.1%	•	Riboflavin 0.155mg 11.9%
Copper 0.185mg 20.6%	•	Vitamin B_{12} 0.437mcg 18.2%
Selenium 6.75mcg 12.3%	•	

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Raw Blackberries

FDA Nutrition Facts

Serving size 140g

Amount per serving

Calories 60

	% Daily Value*
Total Fat 0.69g	**0.9%**
Saturated Fat 0.02g	**0.1%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 1.4mg	**0.1%**
Total Carbohydrate 13.5g	**4.9%**
Dietary Fiber 7.42g	**26.5%**
Total Sugars 6.8g	
Includes 0g Added Sugars	**0%**
Protein 1.95g	

Vitamin D 0mcg 0%	•	Calcium 40.6mg 3.1%
Iron 0.87mg 4.8%	•	Potassium 226.8mg 4.8%
Vitamin E 1.64mg 10.9%	•	Vitamin K 27.7mcg 23.1%
Vitamin A 15.4mcg RAE 1.7%	•	Magnesium 28mg 6.7%
Vitamin C 29.4mg 32.7%	•	Choline 11.9mg 2.2%
Folate 35mcg DFE 8.8%	•	Pantothenic Acid 0.386mg 7.7%
Manganese 0.904mg 39.3%	•	Thiamin 0.028mg 2.3%
Vitamin B_6 0.042mg 2.5%	•	Zinc 0.74mg 6.7%
Phosphorus 30.8mg 2.5%	•	Riboflavin 0.036mg 2.8%
Copper 0.231mg 25.7%	•	Vitamin B_{12} 0mcg 0%
Selenium 0.56mcg 1%	•	

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Pumpkin Pie (commercially prepared)

Proposed Nutrition Facts

Serving size 125g

Scores for nutritional quality based on*

Negative Nutrients **0** Positive & Negative Nutrients **9** Positive Nutrients **11**

Amount/serving	**Level****
Calories 304	Excessive
Total Fat 12.2g	Unsuitable
Saturated Fat 2.48g	Unsuitable
Trans Fat	
Cholesterol 32.5.5mg	Unsuitable
Sodium 299mg	Unsuitable
Total Carbohydrate 43.5g	
Dietary Fiber 2.25g	Unsuitable
Total Sugars 23.6g	Unsuitable
Added Sugars	
Protein 4.88g	Unsuitable

Potassium 208.8mg	Unsuitable	•	Vitamin D 0.12mcg	Unsuitable
Vitamin E 0.95mg	Unsuitable	•	Calcium 80mg	Unsuitable
Vitamin K 16.5mcg	Unsuitable	•	Vitamin A 560mcg RAE	**High**
Magnesium 17.5mg	Unsuitable	•	Vitamin C 0mg	Unsuitable
Choline 46.9mg	Unsuitable	•	Iron 1.13mg	Unsuitable
Folate 46.3mcg DFE	Unsuitable	•	Pantothenic Acid 0.565mg	Unsuitable
Manganese 0.284mg	Unsuitable	•	Thiamin 0.221mg	**Source**
Vitamin B_6 0.079mg	Unsuitable	•	Zinc 0.487mg	Unsuitable
Phosphorus 101.3mg	Unsuitable	•	Riboflavin 0.155mg	Unsuitable
Copper 0.185mg	**Source**	•	Vitamin B_{12} 0.437mcg	**Source**
Selenium 6.75mcg	Unsuitable	•		

* Each food contains three numeric scores from 0 to 100 to show the nutritional quality from the three aspects of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients. A higher score is preferred to a lower score.

** Free, very low, and low levels are used to limit intake of any negative nutrient, and high (excellent source) and source (good source) levels are used to achieve adequate intake of any positive nutrient. If the amount of any nutrient is unsuitable, "unsuitable" is inserted instead of the nutrient level. Also, if the amount of calories is excessive, "excessive" is inserted instead of the calorie level.

Raw Blackberries

Proposed Nutrition Facts

Serving size 140g

Scores for nutritional quality based on*

Negative Nutrients **67** Positive & Negative Nutrients **33** Positive Nutrients **24**

Amount/serving	**Level****
Calories 60	**Low**
Total Fat 0.69g	**Low**
Saturated Fat 0.02g	**Free**
Trans Fat 0g	
Cholesterol 0mg	**Free**
Sodium 1.4mg	**Free**
Total Carbohydrate 13.5g	
Dietary Fiber 7.42g	**High**
Total Sugars 6.8g	Unsuitable
Includes 0g Added Sugars	
Protein 1.95g	Unsuitable

Potassium 226.8mg	Unsuitable	•	Vitamin D 0mcg	Unsuitable
Vitamin E 1.64mg	**Source**	•	Calcium 40.6mg	Unsuitable
Vitamin K 27.7mcg	**High**	•	Vitamin A 15.4mcg RAE	Unsuitable
Magnesium 28mg	Unsuitable	•	Vitamin C 29.4mg	**High**
Choline 11.9mg	Unsuitable	•	Iron 0.87mg	Unsuitable
Folate 35mcg DFE	Unsuitable	•	Pantothenic Acid 0.386mg	Unsuitable
Manganese 0.904mg	**High**	•	Thiamin 0.028mg	Unsuitable
Vitamin B_6 0.042mg	Unsuitable	•	Zinc 0.74mg	Unsuitable
Phosphorus 30.8mg	Unsuitable	•	Riboflavin 0.036mg	Unsuitable
Copper 0.231mg	**High**	•	Vitamin B_{12} 0mcg	Unsuitable
Selenium 0.56mcg	Unsuitable	•		

* Each food contains three numeric scores from 0 to 100 to show the nutritional quality from the three aspects of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients. A higher score is preferred to a lower score.

** Free, very low, and low levels are used to limit intake of any negative nutrient, and high (excellent source) and source (good source) levels are used to achieve adequate intake of any positive nutrient. If the amount of any nutrient is unsuitable, "unsuitable" is inserted instead of the nutrient level. Also, if the amount of calories is excessive, "excessive" is inserted instead of the calorie level.

Fig. 11 Comparison of pumpkin pie (commercially prepared) with raw blackberries based on the FDA Nutrition Facts label and the proposed Nutrition Facts label

Canned Carrot Juice

FDA Nutrition Facts

Serving size **1 cup (240mL)**

Amount per serving

Calories **96**

	% Daily Value*
Total Fat 0.36g	**0.5%**
Saturated Fat 0.06g	**0.3%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 158mg	**6.9%**
Total Carbohydrate 22.2g	**8.1%**
Dietary Fiber 1.9g	**6.8%**
Total Sugars 9.4g	
Includes 0g Added Sugars	**0%**
Protein 2.27g	

Vitamin D 0mcg 0%	•	Calcium 57.5mg 4.4%
Iron 1.1mg 6.1%	•	Potassium 699.1mg 14.9%
Vitamin E 2.78mg 18.5%	•	Vitamin K 37.1mcg 30.9%
Vitamin A 2289mcg RAE 254%	•	Magnesium 33.5mg 8%
Vitamin C 20.4mg 22.6%	•	Choline 23.7mg 4.3%
Folate 9.6mcg DFE 2.4%	•	Pantothenic Acid 0.546mg 10.9%
Manganese 0.31mg 13.5%	•	Thiamin 0.22mg 18.3%
Vitamin B_6 0.52mg 30.6%	•	Zinc 0.43mg 3.9%
Phosphorus 100.5mg 8%	•	Riboflavin 0.131mg 10.1%
Copper 0.11mg 12.2%	•	Vitamin B_{12} 0mcg 0%
Selenium 1.43mcg 2.6%	•	

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Cheeseburger
(large patty; with condiments, vegetables and mayonnaise)

FDA Nutrition Facts

Serving size **195g**

Amount per serving

Calories **522.6**

	% Daily Value*
Total Fat 30.8g	**39.5%**
Saturated Fat 11.2g	**56%**
Trans Fat 1.22g	
Cholesterol 99.5mg	**32.2%**
Sodium 922.4mg	**40.1%**
Total Carbohydrate 34.6g	**12.6%**
Dietary Fiber 2.15g	**7.7%**
Total Sugars 8.8g	
Added Sugars	
Protein 26.7g	

Vitamin D 0.2mcg 1%	•	Calcium 142.4mg 11%
Iron 4.49mg 24.9%	•	Potassium 405.6mg 8.6%
Vitamin E 1.11mg 7.4%	•	Vitamin K 27.7mcg 23.1%
Vitamin A 97.5mcg RAE 10.8%	•	Magnesium 35.1mg 8.4%
Vitamin C 2.15mg 2.4%	•	Choline 71.8mg 13%
Folate 140.4mcg DFE 35.1%	•	Pantothenic Acid 1.47mg 29.4%
Manganese 0.363mg 15.8%	•	Thiamin 0.345mg 28.8%
Vitamin B_6 0.363mg 21.3%	•	Zinc 4.41mg 40.1%
Phosphorus 243.8mg 19.5%	•	Riboflavin 0.5mg 38.5%
Copper 0.158mg 17.6%	•	Vitamin B_{12} 1.814mcg 75.6%
Selenium 32.2mcg 58.5%	•	

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Canned Carrot Juice

Proposed Nutrition Facts

Serving size **1 cup (240mL)**

Scores for nutritional quality based on*

Negative Nutrients **58** Positive & Negative Nutrients **38** Positive Nutrients **33**

Amount/serving	**Level****
Calories 96	**Low**
Total Fat 0.36g	**Free**
Saturated Fat 0.06g	**Free**
Trans Fat 0g	
Cholesterol 0mg	**Free**
Sodium 158mg	Unsuitable
Total Carbohydrate 22.2g	
Dietary Fiber 1.9g	Unsuitable
Total Sugars 9.4g	Unsuitable
Includes 0g Added Sugars	
Protein 2.27g	Unsuitable

Potassium 699.1mg	**Source**	•	Vitamin D 0mcg	Unsuitable
Vitamin E 2.78mg	**Source**	•	Calcium 57.5mg	Unsuitable
Vitamin K 37.1mcg	**High**	•	Vitamin A 2289mcg RAE	**High**
Magnesium 33.5mg	Unsuitable	•	Vitamin C 20.4mg	**High**
Choline 23.7mg	Unsuitable	•	Iron 1.1mg	Unsuitable
Folate 9.6mcg DFE	Unsuitable	•	Pantothenic Acid 0.546mg	**Source**
Manganese 0.31mg	**Source**	•	Thiamin 0.22mg	**Source**
Vitamin B_6 0.52mg	**High**	•	Zinc 0.43mg	Unsuitable
Phosphorus 100.5mg	Unsuitable	•	Riboflavin 0.131mg	**Source**
Copper 0.11mg	**Source**	•	Vitamin B_{12} 0mcg	Unsuitable
Selenium 1.43mcg	Unsuitable	•		

* Each food contains three numeric scores from 0 to 100 to show the nutritional quality from the three aspects of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients. A higher score is preferred to a lower score.

** Free, very low, and low levels are used to limit intake of any negative nutrient, and high (excellent source) and source (good source) levels are used to achieve adequate intake of any positive nutrient. If the amount of any nutrient is unsuitable, "unsuitable" is inserted instead of the nutrient level. Also, if the amount of calories is excessive, "excessive" is inserted instead of the calorie level.

Cheeseburger
(large patty; with condiments, vegetables and mayonnaise)

Proposed Nutrition Facts

Serving size **195g**

Scores for nutritional quality based on*

Negative Nutrients **0** Positive & Negative Nutrients **19** Positive Nutrients **24**

Amount/serving	**Level****
Calories 522.6	Excessive
Total Fat 30.8g	Unsuitable
Saturated Fat 11.2g	Unsuitable
Trans Fat 1.22g	
Cholesterol 99.5mg	Unsuitable
Sodium 922.4mg	Unsuitable
Total Carbohydrate 34.6g	
Dietary Fiber 2.15g	Unsuitable
Total Sugars 8.8g	Unsuitable
Added Sugars	
Protein 26.7g	**High**

Potassium 405.6mg	Unsuitable	•	Vitamin D 0.2mcg	Unsuitable
Vitamin E 1.11mg	Unsuitable	•	Calcium 142.4mg	Unsuitable
Vitamin K 27.7mcg	Unsuitable	•	Vitamin A 97.5mcg RAE	Unsuitable
Magnesium 35.1mg	Unsuitable	•	Vitamin C 2.15mg	Unsuitable
Choline 71.8mg	Unsuitable	•	Iron 4.49mg	Unsuitable
Folate 140.4mcg DFE	**Source**	•	Pantothenic Acid 1.47mg	**Source**
Manganese 0.363mg	Unsuitable	•	Thiamin 0.345mg	**Source**
Vitamin B_6 0.363mg	Unsuitable	•	Zinc 4.41mg	**Source**
Phosphorus 243.8mg	Unsuitable	•	Riboflavin 0.5mg	**Source**
Copper 0.158mg	Unsuitable	•	Vitamin B_{12} 1.814mcg	**High**
Selenium 32.2mcg	**High**	•		

* Each food contains three numeric scores from 0 to 100 to show the nutritional quality from the three aspects of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients. A higher score is preferred to a lower score.

** Free, very low, and low levels are used to limit intake of any negative nutrient, and high (excellent source) and source (good source) levels are used to achieve adequate intake of any positive nutrient. If the amount of any nutrient is unsuitable, "unsuitable" is inserted instead of the nutrient level. Also, if the amount of calories is excessive, "excessive" is inserted instead of the calorie level.

Fig. 12 Comparison of canned carrot juice with cheeseburger (large patty; with condiments, vegetables and mayonnaise) based on the FDA Nutrition Facts label and the proposed Nutrition Facts label

diseases and meet nutritional needs. However, inaccurate nutrition labeling can mislead consumers by providing unsuitable nutritional assessments, which can elevate the risk of certain chronic diseases and cause huge medical costs. So, inaccurate nutrition labeling should be avoided.

A study of 8,596 foods from the National Nutrient Database of the USDA revealed that only 0.2% of foods are customarily consumed 100 g or 100 mL per eating occasion. Because most foods are customarily consumed in amounts greater or less than 100 g or 100 mL per eating occasion, it is very difficult to monitor intakes of nutrients through nutrition labels based on 100 g or 100 mL. Also, % DVs for nutrients, nutrient levels, and nutritional quality scores or symbols on nutrition labels are unsuitably displayed based on 100 g or 100 mL in many foods, which can mislead consumers. Thus, it is not reasonable to provide nutrient information based on 100 g or 100 mL on nutrition labels. Despite the fact that providing nutrient information based on 100 g or 100 mL on nutrition labels is an incorrect approach, unfortunately, most of the nutrient regulations in the world are based on 100 g or 100 mL.

The Nutrition Facts label regulated by the FDA: (1) cannot make a significant contribution to the prevention or reduction of obesity and overweight due to the minimal role (minimal contribution) of energy (calories) in the nutrition label, the voluntary inclusion of energy levels (low and free claims for energy) on the nutrition label, and unsuitable regulatory definitions of energy levels, thereby increasing the risk of certain chronic diseases and medical costs; (2) makes food choices difficult and time-consuming due to the lack of nutritional quality scores or symbols and voluntary inclusion of nutrient levels (free, very low, low, source, and high claims for nutrients), which can result in making uninformed food choices or decreased use of the nutrition label; (3) helps consumers choose some foods containing excessive energy due to exaggeration in % DVs and specified levels (high and source claims) for positive nutrients, which can lead to obesity or overweight; (4) helps consumers choose some foods high in negative nutrients (including energy/calories, *trans* fat, saturated fat, sodium, cholesterol, sugars, and fat) due to very lenient criteria of low claims for negative nutrients or the lack of the low claim for sugars, which can increase the risk of certain diet-associated chronic diseases; (5) discourages consumers from choosing some foods low in negative nutrients due to very strict criteria of low claims for negative nutrients; (6) helps consumers choose foods high in *trans* fat or saturated fat and low in cholesterol due to the understatement of % DVs for cholesterol, which can increase the risk of elevated blood LDL cholesterol concentrations; (7) helps consumers choose some small serving foods high in negative nutrients due to the understatement of % DVs for negative nutrients, which can increase the risk of certain diet-associated chronic diseases; (8) discourages consumers from choosing some nutritious foods by voluntary inclusion of many positive nutrients on the nutrition label; (9) eliminates the ability of consumers to monitor their intake of many positive nutrients and to identify and compare foods in terms of many positive nutrients by voluntary inclusion of many positive nutrients on the nutrition label; (10) encourages unsuitable or excessive uses of fortification by using % DVs for positive nutrients; and (11) promotes fortified foods by mandatory listing positive nutrients that are added to foods and degrades unfortified foods by voluntarily listing positive nutrients (except for six positive nutrients) that occur naturally within foods.

The proposed Nutrition Facts label does not have the vulnerabilities of the FDA Nutrition Facts label. The proposed Nutrition Facts label uses nutrient levels instead of % DVs for nutrients. Nutrient levels on the proposed Nutrition Facts label provide accurate and quick interpretation of information for the target nutrient by considering the amount of the target nutrient and other factors affecting the target nutrient in the context of a daily diet. The proposed Nutrition Facts label contains nutritional quality scores. These scores can be used to understand the nutritional quality of any food in the context of a daily diet from the three aspects of negative nutrients (to limit intake of any negative nutrient), positive nutrients (to achieve adequate intake of any positive nutrient), and a combination of positive and negative nutrients (to achieve adequate intake of any positive nutrient and to limit intake of any negative nutrient) in a summary, simple, and quick way.

The amounts of nutrients per serving on the proposed Nutrition Facts label are used to monitor intakes of nutrients. Nutrient levels on the proposed Nutrition Facts label are used to interpret information for individual nutrients in the context of a daily diet and to identify and compare foods in terms of any nutrient. Nutritional quality scores on the proposed Nutrition Facts label are used to interpret information for many nutrients in the context of a daily diet and to identify and compare foods in terms of negative nutrients, positive nutrients, and a combination of positive and negative nutrients.

Obesity and overweight are associated with various diseases and huge medical costs and are the major health challenges for many countries of the world, such as the United States of America. However, due to the minimal role (minimal contribution) of energy (calories) in the nutrition label, the voluntary inclusion of energy levels (low and free claims for energy) on the nutrition label, and unsuitable regulatory definitions

of energy levels, the FDA Nutrition Facts label cannot make a significant contribution to the prevention or reduction of obesity and overweight. Energy (calories) is the only component of the FDA Nutrition Facts label that can play a role in preventing or reducing obesity and overweight. However, since energy levels are voluntarily specified on the FDA Nutrition Facts label and energy levels are unsuitably defined in the FDA regulations, the FDA Nutrition Facts label cannot properly help consumers identify and choose foods with suitable energy amounts. Energy levels are properly defined in the proposed Nutrition Facts label, and most components (including nutritional quality score based on negative nutrients, nutritional quality score based on positive nutrients, nutritional quality score based on a combination of positive and negative nutrients, energy/calories, dietary fiber, protein, vitamins, and minerals except sodium) on the proposed Nutrition Facts label are related to energy. Thus, the proposed Nutrition Facts label can encourage consumers to choose foods with suitable energy amounts and discourage consumers from choosing foods with excessive energy amounts through the influence of energy on most components of the proposed Nutrition Facts label. The influence of energy can be large, small, or zero depending on the energy amounts.

The proposed Nutrition Facts label helps individuals who desire to comply with dietary recommendations from health care providers or public health guidance. The proposed Nutrition Facts label is an accurate, convenient, and quick information tool for making informed food choices to reduce or prevent diet-associated chronic diseases and to meet nutritional needs in the context of daily energy needs.

Abbreviations

FDA	U.S. Food and Drug Administration
DV	Daily Value
% DV	Percent Daily Value
RACC	Reference amount customarily consumed
USDA	U.S. Department of Agriculture
HHS	U.S. Department of Health and Human Services
NCDs	Noncommunicable diseases

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