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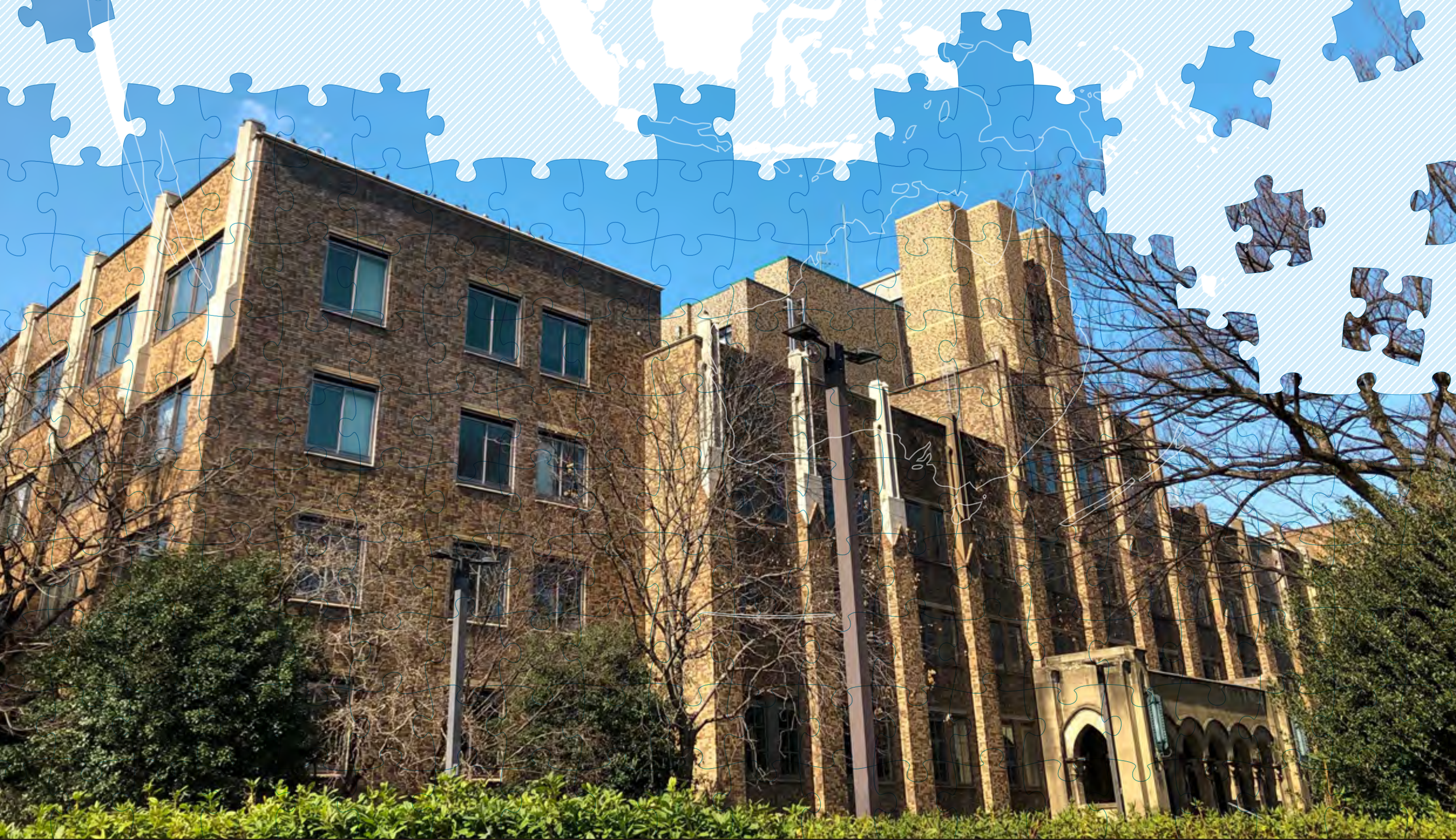
Toward the Simplification of Nutrition Labeling in Japan



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Toward the Simplification of Nutrition Labeling in Japan

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Abstract: The adoption of a simplified nutrition label, called a "nutrition score (Nutri-Score1)", has been considered within the EU in recent years. In this study, we first examine consumers' decision-making processes when purchasing food. Next, we examine the results of a questionnaire administered by the Consumer Affairs Agency regarding how consumers attach importance to nutrition label information. Based on this information, we propose the development of a suitable nutrition label design and standard. Despite a relatively low percentage of correct answers to questions about interpreting energy display information, respondents expressed a preference for referring to nutrition labeling rates. Based on these findings, we recommend that nutrition labels be presented in a battery-level format as part of a universal design approach as opposed to the current nutrition label format. Thaler and Sunstein (2008) mention that a conscientious "choice architect" aims to help people make better choices as judged by themselves. A "choice architect" can change people's behavior without regulations. Our focus lies in enhancing the design aspects that influence people's choices and behaviors and ultimately encouraging consumers to make healthier food choices and prompting manufacturers to produce healthier meals.

Keywords: *Consumer understanding, Nutrition label, Nutri-Score, Choice architect.*

1. INTRODUCTION

In Japan, nutritional information labeling became mandatory in 2020 with the implementation of a new food labeling system. The Consumer Affairs Agency is currently considering the introduction of a new barcode-reading smartphone application to complement the existing labeling format. This application will provide information on nutritional content and ingredient names, including allergens and additives, for products sold in physical stores such as supermarkets[1]*. According to the postsurvey, 26.0% of respondents who reported changing their purchase decisions after using the application were influenced by "food allergy information," 24.0% by "nutritional ingredients," and 20.0% by "additives" among the food labeling elements. Similarly, 24.0% of the respondents selected “additives” as their influencing factor.

Conversely, those who expressed reluctance to use the system asserted that "it is difficult to use because it is almost always an error when scanning with barcodes," "I did not perceive any difference from looking at the package myself," " operating a smartphone is troublesome when shopping with children," and "if there was something more fitting for me, I would like to use it." These responses suggest that there are still unresolved issues associated with the display of the barcode-reading application.

In this study, we propose the empirical idea of Japan’s new food labeling system using behavioral economics methods such as nudges while considering trends outside of Japan. Specifically, we investigate the need to design labels for scenarios where consumers may not have the time or inclination to read the labels thoroughly despite the mandatory inclusion of ingredient information, including allergens and additives, both in Japan and abroad. A particular focus should be placed on designing displays using universal design (hereinafter referred to as "UD"), which includes elements such as pictograms. To achieve this, the concept of "choice architects", as introduced by Thaler and Sunstein in behavioral economics, will be employed. A choice architect designs an environment that guides people's behavior in a desirable direction and encourages voluntary decision making by optimizing the way information is presented without resorting to prohibitions or conventional economic incentives such as rewards or fines.

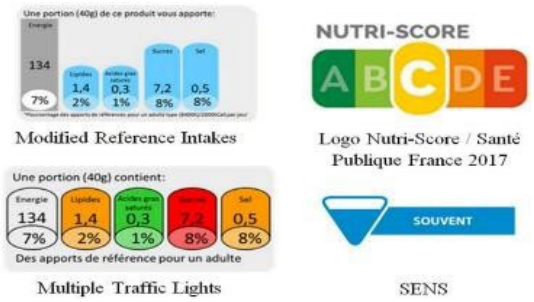
2. PREVIOUS RESEARCH

2-1. Nutri-Score Labeling

Under the EU’s regulatory rules 1169/2011, consumers already have access to the necessary information to make food choices based on nutritional value. However, consumers often struggle to fully comprehend these critical details. Therefore, the EU has contemplated the adoption of a simplified nutrition label, called a "nutrition score (Nutri-Score[1])", which uses color coding (ranging from A-E, with A in green indicating the healthiest and E in red indicating the least healthy) to convey the health impact of foods. This labeling system was developed as an effective certification to encourage healthier food choices among consumers (see Figure 1, upper right).

Figure 1: Nutri-Score (upper right), a nutrition label under consideration in the EU.
Source: Egnell et al., 2018.

The Nutri-Score is calculated for 100g servings and considers the amount of sugar, saturated fatty acids, sodium, energy, fiber, and protein. The food type (fruits, vegetables,



legumes, nuts, etc.) also influences the score (Deschasaux et al., 2018).

Furthermore, the Nutri-Score incorporates elements of UD, which aims to make designs usable by all individuals to the greatest extent possible without requiring adaptation or specialized design. Moreover, the Ministry of Health of Italy supports the “Nutrinform Battery” as a food labeling system within the EU negotiations as an alternative to the Nutriscore traffic-light system. The Nutrinform system is characterized by its nondiscriminatory nature and relies on objective and tamper-proof data.

Balcombe et al. (2010) conducted a data analysis of consumer evaluations of nutrient labeling by traffic lights (traffic light system, TLS) through selective experiments. The experimental results indicated that many subjects tended to avoid foods marked with a red light, signifying excessive content. This underscores the substantial impact

[1] *According to the "Research Report on the Food Labeling Demonstration Project Using Applications," 2021, published by the Consumer Affairs Agency, a store demonstration with 156 monitors was conducted in December 2020.

of using traffic lights as a policy in display methods.

In contrast, Andrews et al. (2011) conducted a study involving frozen foods in which they examined three different approaches to nutritional labeling. They compared a simple nutritional appeal label placed on the front surface of the product package, a slightly more complex traffic signal format label, and a comprehensive nutritional composition table on the back surface. Consumer evaluations of these products were analyzed by categorizing them into groups with and without a nutrition label on the back surface. Their findings indicated that foods with a simple nutrition label on the surface received higher nutritional evaluations. Chiba (2020) summarized the current status and issues related to nutrition labeling systems in each region (Chiba, 2022). Additionally, Lim et al. (2020) explored the competitive effects of front-of-package nutrition labeling.

Variyam's (2008) earlier research analyzed the impact of nutritional information on consumers and considered the case of the Nutrition Labeling and Education Act (NLEA), an American mandatory nutrition labeling system that was launched in 1994. According to the United States Department of Agriculture (USDA), data from the Continuing Survey of Food Intakes by Individuals (CSFII) and Diet and Health Knowledge Survey (DHKS) from 1994 to 1996 are affected by labeling usage and mandatory labeling. The effect of mandatory labeling was estimated by the difference-in-differences model based on nutritional intake from eating at home and did not consider eating out.It was observed that the intake of dietary fiber and iron increased (Andrews et al., 2011).

Nestlé has implemented the Nutri-Score for food and beverages in eight EU countries: Austria, Belgium, France, Germany, Luxembourg, Portugal, Spain, and Switzerland (Chiba, 2022).

Egnell et al. (2018) demonstrated the validity of the score label based on the results of a cohort investigation using four label displays (Figure 1) containing a score label.

However, labels often lack information on food additives and allergens. Therefore, implementing a comprehensive new labeling system requires careful planning. Moreover, the pros and cons of nutrition labeling are related to mandating and to the effects.

2-2. Decision-Making Frameworks

Figure 2 presents the conceptual model used in this study, which was adapted from Grunert et al. (2010). Briefly, for nutrition labels to have an effect, consumers must first be exposed to and aware of them. The effect is mediated by consumers' understanding, which in turn is affected by consumers' nutrition knowledge. Based on their understanding, consumers may use label information to make inferences about the healthiness of a product, which, together with other information (e.g., the product's taste), may affect their evaluation and, ultimately, their purchase decision about the product. This study focused on the aspects of exposure, perception, understanding (both conceptual and substantial), inference (related to healthiness), and nutritional knowledge.

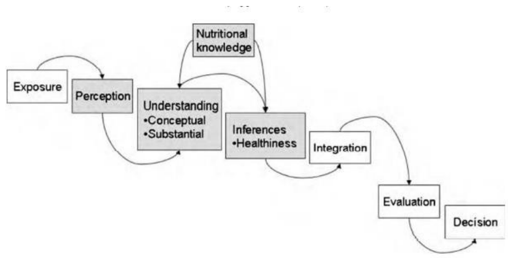


Figure 2: Conceptual framework of nutrition knowledge use and understanding of nutrition information on food labels among UK consumers. Source: Grunert et al. (2010, p. 178; Fig. 1)

2-3. Behavior Change as a Nudge with Regulations

Richard Thaler, a proponent of nudge theory, defines it as "every element of a choice architect that predictably changes people's behavior without banning choices or significantly changing economic incentives" (Thaler and Sunstein, 2008). Nudging is considered an effective and versatile approach in contemporary policymaking due to its ease of implementation.

Behavior change programs and policies rarely rely on nudges alone and more often appear alongside traditional economic approaches, such as taxation or information provision. For example, labels with the same purpose can have differing effects on consumer behavior by slightly changing the amount of information included or the message to be conveyed (Elofsson et al., 2016).

Importantly, however, , while nudging is effective at promoting behavioral change, it may sometimes lead to unintended consequences, including the "boomerang effect" or rebound effect. For example, studies on food calorie labeling show that people with low self-control experience "emotional taxes", which are primarily associated with very little behavioral coordination that benefits them (Thunström, 2019).

Moreover, a study by Yu and Jaenicke (2020) revealed a correlation between dietary health and food waste. This suggests that programs designed to promote a healthy diet and increased consumption of fresh food may result in increased food wastage by consumers (Yu and Jaenicke, 2020).

According to a large-scale global survey that used the nudge method (Sunstein & Reisch, 2019), approximately 80% of people in other countries support mandatory nutrition labeling with simplified information. However, its support in Japan remains at 55%. The reason why Japanese consumers are cautious about this labeling has not been determined.

The central focus of this study is on designing strategies that facilitate better decision-making without restricting choices, often referred to as “choice architecture.” This approach aims to guide individuals to make wiser choices and is a means of changing behavior without the need for regulatory measures. In essence, it seeks to implement nudges that encourage people to make “better choices.”

3. CORRECT UNDERSTANDING OF NUTRITIONAL LABELS

3.1. Data and participants

In this study, we utilized data from the "Consumer Affairs Agency Public Finance Project: Consumers' Reading of Nutrition (Internet Survey) Labels (Data No. SSJDA0954)" collected from February 10-12, 2014. The survey aimed to reach 6,000 men and women aged >20 years from a pool of approximately 1,500,000 eligible registered users across the nation. Participants with dietetic technical knowledge, such as dietitians, were excluded. The sampling was stratified to match the national percentage and census for the 2010 fiscal year, resulting in a random selection of 177,180 candidates.

We obtained the data for this secondary analysis from the Social Science Japan Data Archive Center. We received secondary data from the Social Research and Data Archives, Institute of Social Science, and theUniversity of Tokyo.

Gender, age, education level, household annual income, and the presence of disease (high blood pressure [HBP], diabetes [DM], or hyperlipemia [HL]) were considered. These attributes were assessed based on the correct understanding of the nutritional information displayed. The observation group comprised 5,758 participants after excluding those who did not reference either the front or back side of food labels. A Mann–Whitney U test was conducted to assess the participants’ understanding of the label (energy). While both genders were represented in each group, their ratios differed significantly (z = -2.066, p =0.0388).

For participants with HBP, the difference was statistically significant (z = 3.989, p = 0.0001) with a significance level of 0.05. The understanding of the label was also assessed using a Pearson chi-square test, which accounted for all education levels (university, high school/college, junior/primary school). The results revealed statistically significant differences in the mean education levels between the groups (Pearson chi-square = 43.1741, Pr = 0.000) as well as age (Pearson chi-square = 72.3189, Pr = 0.000). However, household annual income levels exhibited no significant differences among the groups (Pearson chi-square = 0.1283, Pr = 0.938). Participants with DM (z = 1.179, p = 0.2384) or HL (z = 0.889, p = 0.3740) did not demonstrate values below the significance level of 0.05; thus, the null hypothesis was accepted.

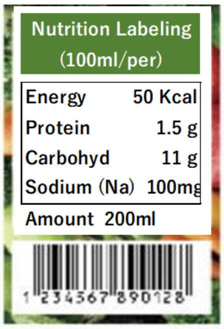


Figure 3: Nutritional information display (flipside)

3.2. Correct carbohydrate understanding

Q: Please select the item that represents carbohydrate nutritional information.

A: (1) non-fibrous-carbohydrates, (2) non-fibrous-carbohydrates
＋dietary fiber, (3) non-fibrous-carbohydrates＋collagen, or (4) not applicable

Although the correct answer is (2) "non-fibrous-carbohydrates + dietary fiber," across all education levels, only 23-24% of respondents provided the correct answer (Pearson chi-square = 20.9441, Pr = 0.002). Notably, carbohydrates comprise both non-fibrous carbohydrates and dietary fiber, but current dietary recommendations often focus on restricting "non-fibrous carbohydrates" as an effective dieting strategy. Simultaneously, the active consumption of "dietary fiber" is encouraged to manage constipation. Consequently, the juxtaposition of restricting “non-fibrous carbohydrates” while recommending “dietary fiber” appears contradictory and may lead to confusion among consumers.

Table 1: Participants’ basic nutritional knowledge (non-fibrous carbohydrates + dietary fiber) by

education level

Education Level	carbohydrates 1	2	3	4	Total
Universty	1,551 63.18	566 23.05	65 2.65	273 11.12	2,455 100.00
highschool/college	1,897 60.32	758 24.10	63 2.00	427 13.58	3,145 100.00
juniorhigh/juniorsc..	81 52.94	36 23.53	6 3.92	30 19.61	153 100.00
Total	3,529 61.34	1,360 23.64	134 2.33	730 12.69	5,753 100.00

3-3. Reading investigation of energy rates

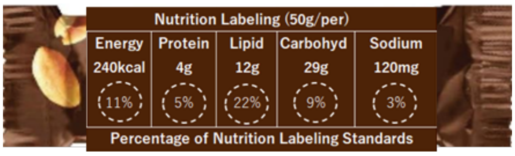


Figure 4: Understanding energy by rate

Q: What does "11%" in the "energy" column mean?

A: (1) If one serving this food is eaten, I can consume 11% of the energy required per day.

(2) If one serving is eaten, I can consume 11% of the energy required per meal.

(3) If one serving is eaten, I can consume 11% of the energy recommended for a between-meal snack per day.

(4) Eleven percent of this food is energy.

(5) None apply.

3.3.1. Understanding energy by rate and label display reference (top)

The correct answer to the question regarding the interpretation of an energy display is "If one serving of this food is eaten, I can take in 11% of the energy required per day." Only 2,297 people answered correctly (39.89%), and 1,032 people said, "I referred to the display about the nutrition written to the front of food and chose it" and referred to it ("I always refer to it" and "I am referring to it") (45.05%) (Pearson chi-square = 56.2990, Pr = 0.000).

3.3.2. Understanding energy by the rate and label display reference (flipside)

Conversely, 782 people who answered correctly indicated "I referred to the nutrition display on the package flipside and chose it" and referred to it ("I always refer to it" and "I am referring to it") (46.00%). (Pearson chi-square = 54.8274, Pr = 0.000).

Furthermore, 1,760 people answered "The practical use intention (range with error) of a nutritional display" with "It is better for there to be a nutritional information display even with errors (YES)" (44.97%).

Conversely, 2,154 participants who answered the energy display question incorrectly responded "It is better for there to be a nutritional information display even with errors (YES)" (55.03%).

Regarding "the practical use intention (range with error) of a nutritional information display," the idea of "wanting to utilize the nutritional information display even if it is not understood" was likely responsible for the results, in which more participants answered the energy display question incorrectly (Pearson chi-square = 131.3933, Pr = 0.000).

Table 2: Food Label Needs and Understanding of the Label (Energy)

Needs of Food label	Understanding of the Label (Energy) 0	1	Total
Idon'tno	873 70.57	364 29.43	1,237 100.00
No	434 71.50	173 28.50	607 100.00
Yes	2,154 55.03	1,760 44.97	3,914 100.00
Total	3,461 60.11	2,297 39.89	5,758 100.00

3.4. Understanding of sodium chloride equivalents

Nutrition Labeling (1bottle(200ml)/per)	
Energy	100kcal
Protein	3g
Lipid	0g
Carbohydrate	20g
Sodium	1000mg

Figure 5: Nutritional information display shown by reading investigation of sodium chloride equivalent. ※The switch from the sodium display to the display of the amount of salt equivalent was completed in March 2020.

Q: How much "sodium chloride equivalent" is there per unit?

A: (1) 1.0 g, (2) 1.5 g, (3) 2.0 g, (4) 2.5 g and (5) none apply

We analyzed the results of an investigation of reading the "sodium chloride equivalent". Although the correct answer was (4) 2.5 g, across all education levels, only 20% of the participants provided correct answers, as shown in Table 3 (Pearson chi-square =50.7419, Pr = 0.000).

Table 3: Frequency table of correct understanding of the "sodium equivalent" by education level

Education Level	Salt intake 1	2	3	4	5	Total
Universty	1,176 47.90	693 28.23	307 12.51	238 9.69	41 1.67	2,455 100.00
highschool/college	1,781 56.63	795 25.28	302 9.60	228 7.25	39 1.24	3,145 100.00
juniorhigh/juniorsc..	81 52.94	36 23.53	18 11.76	13 8.50	5 3.27	153 100.00
Total	3,038 52.81	1,524 26.49	627 10.90	479 8.33	85 1.48	5,753 100.00

Furthermore, participants with hypertension (who were diagnosed with HBP or identified by a medical institution or examination in the past year) assumed that salt intake would affect them. Only 7.07% of consumers with hypertension (indicated by 1 in the HBP column) answered correctly (4), showing that they lacked basic knowledge of sodium chloride equivalents.

According to the Ministry of Health, Labor and Welfare (Japan), the annual estimate of medical bills related to HBP in Japan is 1,790,300 million yen, with outpatient costs accounting for 207,700 million yen (Ministry of Health, Labor and Welfare, 2020). These figures underscore the need for a simplified label display to make information about salt ingestion accessible for those with lifestyle-related diseases.

4. EXAMPLE OF NESTLE JAPAN

At Nestlé Japan (Nestle, 2021), clear and easily understandable information is already available on the percentage of a nutrient's quantity per serving for lipids, saturated fatty acids, sugars, and sodium chloride equivalents, which are relevant to an increased risk of lifestyle-related diseases (Figure 6).

In addition to conventional caloric information, the percentages of these ingredients (lipids, saturated fatty acids, sugars, and sodium chloride equivalents) are displayed on the back of the packaging, making it easy for consumers to grasp the daily intake standards at a glance.

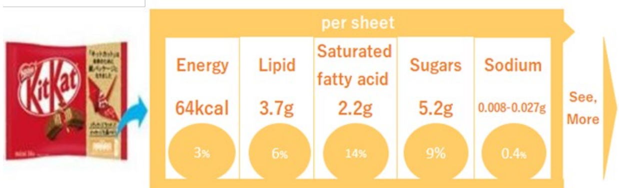


Figure 6: Nutritional labels on the Nestlé Japan packaging
Source: Nestlé the nutritional information display on a product package

The nutritional (calorie) guide display iconifies the quantity per serving of a nutrient and the rate based on ingestion standards. ex) Energy 64 kcal of 1 sheet, 3% of the daily energy intake standard.

Moreover, nutritional information can be accessed using the QR code on the package. A one-serving display based on total daily consumption, like Nestle's, will be more intuitive for consumers.

5. DISCUSSION

5.1. Regulations and Simplification of Nutrition Labeling by Battery Level

The percentage of correct answers to questions related to reading energy labels was generally low, and half of the respondents answered that they would like to refer to the percentages on nutrition labels. Currently, the percentage display is not consistent at the recommended levels.

Therefore, in this research, in addition to the efforts at Nestle, we propose considering label displays from the perspective of UD. According to the Ministry of Italy, "The NutrInform Battery is a new nutritional labeling system developed by Italy to help consumers make informed choices about the food they consume. The system is designed to provide quick and easy-to-understand information about the nutritional content of food products." The Nutrinform Battery is a graphical representation of the percentage of energy and nutrients in a food product relative to the recommended serving size.

We propose adding a score to the content as a percentage and displaying the evaluation level by the remaining battery level. For example, concerning the saturated fatty acids displayed in the packaging of Nestlé's Japanese products, 14% of the 2.2 g of saturated fatty acids, which is a guideline for one sheet, is filled with up to 14% of one battery. It could be replaced with Nestlé Japan's nutrition label (as shown in Figure 6). The new nutrition label is illustrated in Figure 7.

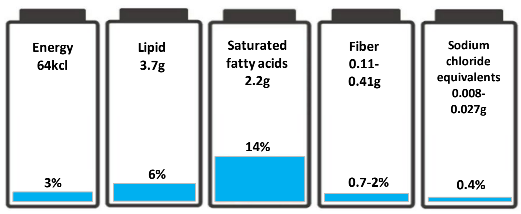


Figure 7: Nutrition label by battery level

For a sheet of chocolate, Energy=64 kcal, 3% per day needed. In our study, we used the recommended dietary intake standard (the recommended amount of nutrients) as the criterion for energy and each nutrient (Ministry of

Health, Labor and Welfare, 2021).

Using the visual battery illustration rather than simply stating the percentage helps to convey how much it contains for the daily guideline. In this case, we use nutrient intake reference values in Japan; for example, salt intake = 7 g/day.

Moreover, since most people use electric devices daily, the battery level is checked frequently, especially when using mobile terminals such as mobile phones. When the battery is low, consumers typically attempt to recharge it.

Replacing this thought process with nutritional intake leads to the understanding "Battery is full = meets the required amount, refrain from further intake" and "Battery is low = insufficient, so we will try further intake." By using the battery illustration, consumers' behavior to naturally fill the remaining battery level is a characteristic of nudge behavior change, which is much more effortless than the conventional type of label.

Furthermore, even for children who do not fully understand the percentage display, battery illustrations can be useful for selecting healthy products (sweets).

For example, if a parent asks a child to choose a food with the least amount of salt equivalent, the child can easily identify it by looking at the illustration, which can serve as an educational tool.

Thaler and Sunstein (2008) emphasize that the goal of a conscientious choice architect is to help people make better choices "as judged by themselves." In our study, we aim to achieve this goal by proposing a nutrition label based on battery levels.

5.2. Policy Implications

The Food Labeling Act in Japan mandates revisions aimed at providing easily understandable information about food for consumers (Act No. 70), establishing reliable labels, ensuring information accuracy, and managing related laws rigorously (Consumer Affairs Agency white paper on consumer affairs, 2019). However, consumers often struggle to comprehend this information. While Ben-Shahar and Schneider (2014) recommend simplifying complex information for ease of use, they also caution that "simplification is a complex business, not readily mastered, and simplification is in tension with the full disclosure principle."

Sunstein and Reisch (2019) mention that the low confidence of Japanese people in their government might be the reason for the lower scores for their acceptance of a nutrition label with simplified information. Japanese people think that checking the nutrition label impacts their health, which is the general public perception, and that they can comprehend information without the need for simplified graphics.

On the basis of the results of this study, we conclude that because Japanese consumers are cautious about this labeling, there is a gap between perceptions and actual behavior. According to the University of Chicago (n.a.), behavioral economics can be understood by Thaler's explanation: "Behavioral economics examines the differences between what people 'should' do and what they actually do and the consequences of those actions." These differences often stem from "bounded rationality," which refers to the fact that people have limited cognitive ability, information and time and do not always make the "correct" choice from an economist's point of view, even if information is available that would point them toward a particular course of action.

Consequently, in Japan, government leaders do not need to implement measures to streamline the situation. It may prove challenging and unnecessary to adopt a NS system similar to the EU's system. In the future, we would like to study more consumer responses to graphic displays through the efforts of private companies that can respond to consumer needs.

6. CONCLUSION

In this research, we examined simplified nutrition labeling systems and evaluated the results of the Consumer Affairs Agency questionnaire regarding the understanding of nutrition labels.

The responses were divided, even though the percentage of correct answers to the problem about reading an energy display was low. We explored whether people "liked to refer to the percentage of nutrition labeling" based on the results.

Currently, there is no clear recommendation for displaying nutrition labels solely by percentage. To create a nutrition label that suits consumers' understanding and needs, we propose further research on ingredient labels that display the necessary information to foster correct understanding based on regulations or scientific arguments.

Based on these results, we suggest displaying nutrition labels using a battery-level approach that aligns with universal design as a choice architect by behavior change techniques. We acknowledge that simplification is a complex endeavor, but we aim to understand how consumers perceive that reading nutrition labels contributes to international food policy discussions.

NOTES

1. The Nutri-Score's Front of Pack (FOP) labeling system is derived from the FSAm-NPS (FSi: score of food/beverage i, Ei: energy intake from food/beverage i,

n: number of food/beverage consumed):

$$\mathrm{FSAm-NPS\ DI} = \frac{\sum_{i=1}^{n}(FS_iE_i)}{\sum_{i=1}^{n}E_i}$$

A higher FSAm-NPS DI therefore reflects lower nutritional quality in foods consumed. For more details on the FSAm-NPS and FSAm-NPS DI calculations, please see the Dietary Index; FSAm-NPS, Nutrient Profiling System of the British Food Standards Agency.

2. The data for this secondary analysis, "Consumer Affairs Agency Public Finance Project: Consumers' Reading of Nutrition (Internet Survey) Labels (Data No. SSJDA0954)," were provided by the Social Science Japan Data Archive, Center for Social Research and Data Archives, Institute of Social Science, The University of Tokyo.

References

Andrews, J.C., Burton, S., Kees, J., 2011. Is simpler always better? Consumer evaluations of front-of-package nutrition symbols. J. Public Policy Mark. 30, 175–190. https://doi.org/10.1509/jppm.30.2.175.

Balcombe, K., Fraser, I., Falco, S.D., 2010. D（2010）Traffic Lights and food choice: A choice experiment examining the relationship between nutritional food labels and price. Food Policy. 35, 211–220. https://doi.org/10.1016/j.foodpol.2009.12.005.

Ben-Shahar, O., Schneider, C.E. 2014. More Than You Wanted to Know: The Failure of Mandated Disclosure. Princeton University Press.

Chiba, T., 2022. Food labeling systems in Japan: Nutrition and health claims: current status and issues on nutrition labeling system in each region (SY(T6)19). J. Nutr. Sci. Vitaminol. 68 Supplement, S101–S103. https://doi.org/10.3177/jnsv.68.S101.

Consumer Affairs Agency white paper on consumer affairs. https://www.caa.go.jp/en/publication/annual_report/2019/pdf/en_summary.pdf. (Accessed 2020.12.31), 2019 (Tentative translation Version). Accessed.

Deschasaux, M., Huybrechts, I., Murphy, N., Julia, C., Hercberg, S., Srour, B., Kesse-Guyot, E., Latino-Martel, P., Biessy, C., Casagrande, C., Jenab, M., Ward, H., Weiderpass, E., Dahm, C.C., Overvad, K., Kyrø, C., Olsen, A., Affret, A., Boutron-Ruault, M.C., Mahamat-Saleh, Y., Kaaks, R., Kühn, T., Boeing, H., Schwingshackl, L., Bamia, C., Peppa, E., Trichopoulou, A., Masala, G., Krogh, V., Panico, S., Tumino, R., Sacerdote, C., Bueno-de-Mesquita, B., Peeters, P.H., Hjartåker, A., Rylander, C., Skeie, G., Ramón Quirós, J., Jakszyn, P., Salamanca-Fernández, E., Huerta, J.M., Ardanaz, E., Amiano, P., Ericson, U., Sonestedt, E., Huseinovic, E., Johansson, I., Khaw, K.T., Wareham, N., Bradbury, K.E., Perez-Cornago, A., Tsilidis, K.K., Ferrari, P., Riboli, E., Gunter, M.J., Touvier, M., 2018. Nutritional quality of food as represented by the FSAm-NPS nutrient profiling system underlying the Nutri-Score label and cancer risk in Europe: Results from the EPIC prospective cohort study. PLOS Med. 15, e1002651. https://doi.org/10.1371/journal.pmed.1002651.

Egnell, M., Ducrot, P., Touvier, M., Allès, B., Hercberg, S., Kesse-Guyot, E., Julia, C., 2018. Objective understanding of Nutri-Score Front-Of-Package nutrition label according to individual characteristics of subjects: Comparisons with other format labels. PLOS ONE. 13, e0202095. https://doi.org/10.1371/journal.pone.0202095.

Elofsson, K., Bengtsson, N., Matsdotter, E., Arntyr, J., 2016. The Impact of Climate Information on Milk Demand: Evidence from a Field experiment. Food Policy. 58, 14–23. https://doi.org/10.1016/j.foodpol.2015.11.002. Ministry of Health of Italy. https://www.salute.gov.it/portale/nutrizione/dettaglioContenutiNutrizione.jsp?id=5509&area=nutrizione&menu=etichettatura. (Accessed 2023.9.16). Nutriform Battery.

Grunert, K.G., Wills, J.M., Fernandez-Celemın, L., 2010. Nutrition knowledge, and use and understanding of nutrition information on food labels among consumers in the UK. Appetite. 55, 177–189. https://doi.org/10.1016/j.appet.2010.05.045.

Lim, J.H., Rishika, R., Janakiraman, R., Kannan, P.K., 2020. Competitive effects of front-of-package nutrition labeling adoption on nutritional quality: Evidence from facts up front–style labels. J. Mark. 84, 3–21. https://doi.org/10.1177/0022242920942563.

Ministry of Health, Labour and Welfare. Estimates of national medical care expenditure. https://www.mhlw.go.jp/toukei/saikin/hw/k-iryohi/18/dl/kekka.pdf, in: FY2018 (2020.12.06b. Accessed).

Ministry of Health, Labour and Welfare. Dietary reference intakes for Japanese (2020). https://www.mhlw.go.jp/content/10904750/000586553.pdf (in Japanese), 2021.10.20b. Accessed.

Nestle. The nutrition-information display on a Nestlé. https://www.nestle.co.jp/stories/nutrition-information, 2021.1.1b. Accessed.

Sunstein, C. R., & Reisch, L. A. 2019. Trusting nudges: Toward a bill of rights for nudging, 146, Routledge.

Thaler, R., Sunstein, C., 2008. Nudge: Improving Decisions About Health, Wealth, and Happiness. Yale University Press.

Thunström, L., 2019. Welfare effects of nudges: The emotional tax of calorie menu labeling. Judgm. decis. mak. 14, 11–25. https://doi.org/10.1017/S1930297500002874.

University of Chicago Office of Communications (n.a.). Behavioral economics, explained. Retrieved May 10, 2023 from https://news.uchicago.edu/explainer/what-is-behavioral-economics#terms

Variyam, J.N., 2008. Do nutrition labels improve dietary outcomes? Health Econ. 17, 695–708. https://doi.org/10.1002/hec.1287.

Yu, Y., Jaenicke, E.C., 2020. Estimating food waste as household production inefficiency. American J. Agri. Economics 102, 525–547. https://doi.org/10.1002/ajae.12036.
. Dietary reference intakes for Japanese (2015) （full）. https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000208970.html, 2021.10.20. Accessed.

APPENDIX

FSAm-NPS score computation at the food/beverage level, FSAm-NPS DI computation at the individual level, and link to the Nutri-Score (Santé Publique France). DI, Dietary Index; FSAm-NPS, Nutrient Profiling System of the British Food Standards Agency (modified version).

See Dietary Index; FSAm-NPS, Nutrient Profiling System of the British Food Standards Agency. https://doi.org/10.1371/journal.pmed.1002651.s005 (2021/1/1 Accessed)

3) Example of FSAm-NPS score computation and link to the Nutri-Score (Santé Publique France)

Food/beverage composition

	A points				C points		
	Energy (kJ)	**Saturated Fat (g)**	**Total Sugars (g)**	**Sodium (mg)**	**Protein (g)**	**Fibre (g)**	**Fruits/ vegetables/ legumes/ nuts (%)**
Food							
Fennel boiled	104.7	0	0.15	73.8	1.69	2.92	100
Anchovy in vinegar	439.6	1.26	0.03	307.9	18.4	0	0
Salami	2097.6	17.5	0.13	1817.3	26.0	0	0
Beverage							
Orange juice fresh	192.6	0.02	5.50	1	0.7	0.1	100
Cola, regular	227.6	0	10.51	4.18	3.03	0	0

Attribution of points

	A points				C points		
	Energy (kJ)	**Saturated Fat (g)**	**Total Sugars (g)**	**Sodium (mg)**	**Protein (g)**	**Fibre (g)**	**Fruits/ vegetables/ legumes/ nuts (%)**
Food							
Fennel boiled	0	0	0	0	1	4	5
Anchovy in vinegar	1	1	0	3	5	0	0
Salami	6	10	0	10	5	0	0
Beverage							
Orange juice fresh	7	0	4	0	0	0	10
Cola, regular	8	0	8	0	1	0	0

1) FSAm-NPS score computation at food/beverage level

Points are allocated according to the nutrient content for 100g of foods or beverages.
Points are allocated for 'Negative' nutrients (A points) and can be balanced according to 'Positive' nutrients (C points).

A points

Total A points = (points for energy) + (points for saturated fat) + (points for total sugar) + (points for sodium)

Points	Energy (kJ)	Saturated Fat (g)	Total Sugars (g)	Sodium (mg)
0	≤ 335	≤ 1	≤ 4.5	≤ 90
1	> 335	> 1	> 4.5	> 90
2	> 670	> 2	> 9	> 180
3	> 1005	> 3	> 13.5	> 270
4	> 1340	> 4	> 18	> 360
5	> 1675	> 5	> 22.5	> 450
6	> 2010	> 6	> 27	> 540
7	> 2345	> 7	> 31	> 630
8	> 2680	> 8	> 36	> 720
9	> 3015	> 9	> 40	> 810
10	> 3350	> 10	> 45	> 900

C points

Total C points = (points for fruits/vegetables/legumes/nuts) + (points for fibres) + (points for proteins)

Points	Fruits/vegetables/legumes/nuts (%)	Fibre (g) *	Protein (g)
0	≤ 40	≤ 0.7	≤ 1.6
1	> 40	> 0.7	> 1.6
2	> 60	> 1.4	> 3.2
3	-	> 2.1	> 4.8
4	-	> 2.8	> 6.4
5	> 80	> 3.5	> 8.0

* FSAm-NPS score allocates different thresholds for fibres, depending on the measurement method used. We used NSP cut-offs to compute fibres score.

For 100g of a given food, the percentage of fruits/vegetables/legumes/nuts is obtained by summing up the amount (in grams) of all fruits, legumes and vegetables (including oleaginous fruits, dried fruits and olives) contained in this food.

Overall score computation

- If Total A points <11, then FSAm-NPS score =Total A points – Total C points
- If Total A points ≥11,
  - If points for fruits/vegetables/legumes/nuts =5, then FSAm-NPS score =Total A points – Total C points
  - Else if points for fruits/vegetables/legumes/nuts <5, then FSAm-NPS score = Total A points – (points for fibre + points for fruits/vegetables/legumes/nuts).

	FSAm-NPS score		Nutri-Score colour
Food			
Fennel boiled	A points – C points	**-10**	Dark green
Anchovy in vinegar	A points – C points	**0**	Light green
Salami	A points – points (fibre) – points (fruits/ veg./ leg./ nuts)	**26**	Dark orange
Beverage			
Orange juice fresh	A points – C points	**1**	Light green
Cola, regular	A points – points (fibre) – points (fruits/ veg./ leg./ nuts)	**16**	Light orange