# Unlocking the potential of nutrition labels: A look at the power of (digital) nudges

BUSE TEZÇI iD

UX Researcher in R&D of RE:LAB SRL, Ph.D. Student in "Humanities and Technologies" in Università degli Studi Suor Orsola Benincasa

ROBERTO MONTANARI iD

Co-founder and R&D Responsible of RE:LAB SRL - Professor of Interaction Design in Università degli Studi Suor Orsola Benincasa

Abstract

*Nutrition labels on food packages play an important role in influencing consumer behavior since their first emergence. However, past research showed that there are limitations to their effectiveness as some consumers do not benefit from them as much as others. A major reason to that is some consumers struggle to interpret the nutritional information listed on the labels, making it difficult to make healthier food choices. To overcome the limitations, digital nudges are being proposed as a solution, making User Experience (UX) an important field in nutrition labeling as the design of effective digital nudges pass through good usability. Digital nudges, personalized recommendation systems can be leveraged and, affective and cognitive UX design strategies can be employed to make it easier for consumers to understand the nutritional information and make healthier food choices. This paper presents a perspective on nutritional labels by proposing to repurpose them as digital nudges, with examples from the literature to support the idea.*

## 1. A short history of Nutrition Labels.

Choosing healthier food options is vital for maintaining good health, but it can be challenging for the general consumer as it is often difficult to determine what constitutes as healthy due to the overwhelming and sometimes conflicting information available. To address this issue, policy makers have implemented nutrition labels as a means of informing and empowering consumers to make informed decisions about the nutritional content of the food and beverages they consume.

Traditionally, nutrition labels can be found on the back or side of packaged foods and provide information about the nutritional content of the product. These labels provide information about the nutrients and ingredients in a product, helping people make healthier choices that support their overall well-being and manage conditions such as high blood pressure, high cholesterol, or diabetes. A typical nutrition label includes the serving size, the number of servings per container, and the amount of calories, fat, cholesterol, sodium, carbohydrates, fibre, total and added sugar and protein in each serving. In addition to this basic information, some nutrition labels may also include information about vitamins and minerals, as well as any added sugars or ingredients that may be of concern, such as food allergens.

Nutrition labels have a long history, with the first ones being developed in the United States by the Food and Drug Administration (FDA) in 1994 following the passage of the Nutrition Labeling and Education Act (NLEA) in 1990. This act required most packaged foods to include a nutrition label, and it established certain requirements for the content and format of the label. Since then, the nutrition label has undergone several updates to reflect new scientific information and consumer needs. In 2016, the FDA issued the Nutrition Facts Label Final Rule, which made significant changes to the label to incorporate the latest scientific findings, including the connection between diet and chronic health conditions like obesity and heart disease. This was done with the goal of assisting consumers in making more informed food choices, such as the addition of a line for added sugars, the inclusion of daily values for vitamin D and potassium, and the removal of the "Calories from Fat" line.[1]

---

[1] FDA, 'At a Glance: Highlights of the Nutrition Facts Label' <https://www.fda.gov/media/98098/download> accessed 31 January 2023.

## 2. The effectiveness of nutrition labels: An examination of the role of nudges.

Tackling with public health issues, such as heart disease and obesity has been a challenge that many researchers attempt to seek causes and solutions. Consequently, since the first emergence of the nutrition labels, their effectiveness and whether consumers benefit from them or not have been a topic of research interest.

Up until now, numerous research indicated that interacting with nutrition labels and food labeling influence consumer behavior and food choices towards healthier food options even though this effect was not found to be homogenous among all nutrition information [2] or consumers. The differences in consumer behavior are more evident in studies in which sample characteristics played an important role in engaging with nutrition labels. For example, in a study conducted with an Italian cohort, researchers investigated how socio-economic and demographic characteristics play a role in the effectiveness of nutrition labels. In the study, authors observed that reading nutrition labels including product ingredients were negatively associated with Body-Mass Index (BMI). However, this negative association was stronger for the participants who already had a higher BMI score and for the ones that risk being overweight and obese. The latter group, moreover, included individuals from lower income and lower educational groups compared to average.[3] In another study conducted in Thailand with a cohort of almost 43 thousand participants, it was observed that who had already poor health conditions, such as high blood pressure or engaged in poor health activities excessive alcohol consumption and frequent smoking, reported less frequent use of nutrition labels. Furthermore, females, participants that work out often, older participants and participants who live in rural regions reported more frequent interaction with nutrition labels. [4]

Overall these differential results point towards a heterogeneous utilization of nutrition labels by consumers, which eventually bring about differences in consumer behavior, even though a general trend could be seen towards overall better food options. This could be interpreted as a need for getting to know the consumers better and follow a "personalized" approach rather than a "one-size-fits-all" one.

Even though previous research shows effectiveness of nutrition labels may vary depending on the consumer characteristics, it is also evidenced that nutrition labels help people engage in healthier food choices. A strong theory why the nutrition labels' have an effect on consumer behavior is the Nudge Theory. The infamous Nudge Theory that was introduced by Thaler and Sunstein in 2008,[5] indicates that, by making changes in the so-called "choice architecture" that the consumers live in, it is possible to "gently push" people towards the better option, nudging them away from the irrational decisions. Because the choice architecture is essentially inevitable, making the better

---

[2] S Shangguan and others, 'A Meta-Analysis of Food Labeling Effects on Consumer Diet Behaviors and Industry Practices' (2019) 56 Am. J. Prev. Med., 300-314.

[3] A Bonano and others, 'Food labels and adult BMI in Italy – an unconditional quantile regression approach' (2018) 74 Food Policy, 199–211.

[4] W Rimpeekool and others, 'Nutrition label experience, obesity, high blood pressure, and high blood lipids in a cohort of 42,750 Thai adults' 12(12) PLoS One, 1-12.

[5] R H Thaler, C R Sunstein, 'Nudge: Improving decisions about health, wealth, and happiness' (Yale University Press, 2008).

option more salient or readily present as the default-choice, consumers are not challenged to show effort to opt for the better. Rather by making these changes and increasing the visibility of the better, people are not forced as they still have the freedom of choice. [5]

The great assumption of the theory comes from the claim that people are "irrational" decision-makers as they base their decisions on behavioral and cognitive biases that help them to make faster choices. People in their daily lives are subject to various biases and these biases cause them to grow a tendency to create their reality not necessarily on evidence but on the interpretation of the possessed information. Therefore, the task of a choice architect and of a nudge theorist is not to directly eliminate the irrational or unwanted decision from the environment but rather introduce the better one as almost status-quo to realign consumer's reality with the better option.

Nudge theorists, hence, argue that the reason nutrition labels work on food choice is displaying the nutritional information of food products, consumers are influenced or "nudged" towards the healthier ones.[6] Despite the positive effects of displaying nutritional information as a nudging technique, there exist essential prerequisites that must be satisfied to guarantee its positive impact. Marlow proposes a probability model that could be a framework to understand the reason differential and non-homogenous effects are seen previously. According to his probability model, there are four steps involved, and each step has a certain likelihood of happening that ultimately impacts the overall likelihood of a consumer making a healthy choice. The steps are reading the label, understanding the label, opting for the healthier option, and ultimately experiencing an improved health outcome in the long term due to changes in diet. Let's consider that there is a low probability in any of these steps, for <example, a low probability of a consumer reading or comprehending the label, the probability of improved health outcomes decreases. [6] As simplistic as this model, it is a great way to highlight why nudges, in this case especially nutritional labels, should be presented to a consumer in a way to attract them to first read the label and then comprehend well the meaning that nudge is trying to emit.

Under this assumption, some of the major hindrances to reaching high probabilities of healthier diets using nutritional labels are consumers not reading the labels and, even if they read them, not being able to understand the information due to the complex nature of labels. This complexity is a great obstacle as some consumers might find it specifically difficult to understand the information due to intrapersonal differences or willingness in consumers. This could be due to not being familiar with the information or the way the information is presented and eventually result in hardship for people to use the label to make informed choices about the foods and beverages they consume. [7] Furthermore, there is no standard way for food manufacturers to present information on a nutrition label, which can make it hard for consumers to compare products. For example, some labels may list nutrients per serving, while others may list them per 100 grams. [8]

---

[6] M L Marlow, 'Label Nudges' (2017) 40(24) Regulation, 24-29.

[7] W Rimpeekool and others, '"I rarely read the label": Factors that Influence Thai Consumer Responses to Nutrition Labels' (2015) 8(1) Glob J Health Sci, 21-28.

[8] C Stones, 'Online Food Nutrition Labelling in the UK: How consistent are supermarkets in their presentation of nutrition labels online?' (2016) 19(12) Public Health Nutr, 2175-2184.

Despite these challenges, nutritional labels have the potential to be an effective nudging strategy, and there is room for improvement from the consumer's perspective. As technology advances and consumer behavior evolves, it is possible to address the limitations of nutritional labels and improve the experience for consumers and tailor personalize experiences depending on consumer needs.

### 3. Leveraging Digital Nudges and User Experience Strategies to Consider.

The required labor in reading, understanding and eventually interpreting nutrition labels can pose a significant barrier between consumers and making healthy choices. To overcome this barrier, it is essential as a first step to make the information more accessible and comprehensible. This can help address documented issues and to mitigate the detrimental effects, such as disparities among consumer groups, that have been documented in the existing literature. By simplifying the information and making it more widely available and providing an experience that is suitable for each consumer depending on their needs, nutrition labels can better support consumers in their efforts to adopt healthy eating habits.

The way consumers purchase food has greatly changed in recent years, with a shift from physical stores to digital platforms like online grocery shopping and food delivery apps.[9] This shift has important effects on nutrition labels, as the digital mediums offer new opportunities to "nudge" consumers towards healthier food options by overcoming the complexity of nutritional label reading. Digital nudges can offer a more personalized and adaptive approach than traditional nutrition labels and have the potential to better support consumers in adopting healthy eating habits. Studies have shown that the varied results from different consumer groups[3, 4] might suggest the need for personalized systems that can recommend food options based on the consumer's profile. Although there is limited research on personalized digital nudges in nutrition labels, initial studies have explored the effectiveness of personalized recommender systems in promoting healthier food choices. These studies found that the level of health consciousness of the users was an important factor in evaluating the recommender system, highlighting the importance of correctly identifying the needs of the target audience.[10] Additionally, when the nutrition label presentation was personalized, it helped reduce the difficulty of making food choices.[11] Besides, personalized systems possess the capacity of incorporating user's dietary requirements due to current health status or chronic medical conditions, such as dietary restriction requiring diseases or allergies. Thus, personalized recommender systems could be an integral part of nudge design strategies and ensure that the digital nudge is tailored to meet the unique needs of each user.

---

9 C Li, M Mirosa, P Bremer, 'Review of Online Food Delivery Platforms and their Impacts on Sustainability' (2020) 12(14) Sustainability, 5528.

10 A Starke, A El Majjodi, C Trattner, 'Boosting Health? Examining the Role of Nutrition Labels and Preference Elicitation Methods in Food Recommendation' [2022] Interfaces and Human Decision Making for Recommender Systems, 67-84.

11 A El Majjodi, A D Starke, C Trattner, 'Nudging towards health? examining the merits of nutrition labels and personalization in a recipe recommender system' [2022] In Proceedings of the 30th ACM Conference on User Modeling, Adaptation and Personalization, 48-56.

Another potent method to use digital sources for nutrition is by utilizing strategies that consumers are already familiar with or can easily adapt to. The increasing integration of technological devices in daily life, such as computers, tablets, smartphones, and smart televisions, provides choice architects and policy makers with the opportunity to expand the use of nutrition labels from only existing on products to digital sources in consumers' own devices as such as fitness and nutrition websites and apps to get information about nutritional information online. [12] This points towards the importance of User Experience (UX) in designing the kind of information that consumers can easily access and creating a choice environment that provides nutritional information deliberately to consumers. Thus, digital nudges, or the use of nudges in online contexts, [13] holds great potential for the future of nutrition labeling. It becomes the responsibility of UX professionals to enhance the interaction between digital nudges and consumers. Thus, in addition to striving for a successful nudge strategy, it is also essential to prioritize good usability, providing consumers with a positive experience that boosts their chances of achieving positive health outcomes,  as Nielsen mentions "On the Web, usability is a necessary condition for survival" [14]. This means, while designing for UX strategies for digital platforms, it is fundamental to understand the importance of good usability practices and design strategies that can support users from cognitive and affective domains. Nutrition labels that are known in classical terms are an example of a nudge that aims to influence a consumer cognitively, as this type of nudges are descriptive and relay the objective information in text and numbers, [15] which can be confusing to some consumers, as interpretation of these information is usually required. Therefore, transforming the descriptive information into tangible visuals or creating supplementary visual aids such as incorporating symbols or emoticons, could help consumers to quickly identify a healthier or less healthier option. For instance, calorie values could be difficult to interpret for those not well-versed in nutrition. Concrete visual representations, such as linking calorie intake to the amount of physical activity required to burn them, can effectively convey information, and inspire healthy behavior, as demonstrated by a study.[16]

Additionally, efficient use of colors, such as color coding, could be a useful visual cognitive strategy. Indeed, using the traffic-light-coding system, where unhealthy items are coded with red and healthy items are coded with green has been shown to be effective. Studies have shown that labeling unhealthy items in this way has led to a decrease in sales of unhealthy food and an increase in sales of healthy food. [17]

The cognitive UX strategies extend, not only for classical means, such as websites and mobile phone applications, but also to new technologies, such as Augmented Reality

[12] J Sauro, 'The UX of fitness and nutrition websites' (MeasuringU, 2020) <https://measuringu.com/ux-fitness/> accessed 31 January 2023.

[13] M Weinmann, C Schneider, J V Brocke, 'Digital Nudging' (2016) 58 Bus Inf Syst Eng, 433–436.

[14] J Nielsen, 'Usability 101: Introduction to usability' (Nielsen-Norman Group, 2012) <https://www.nngroup.com/articles/usability101-introduction-to-usability/> accessed 31 January 2023.

[15] R Cadario, P Chandon 'Which Healthy Eating Nudges Work Best? A Meta-Analysis of Field Experiments' (2019) 39(3) Marketing Science, 465-486.

[16] C B Deery and others, 'Physical activity calorie expenditure (PACE) labels in worksite cafeterias: effects on physical activity' (2019) 19(1) BMC Public Health 19, 1-10.

[17] A N Thorndike and others, 'A 2-phase labeling and choice architecture intervention to improve healthy food and beverage choices' (2012) 102 Am. J. Public Health, 527–533.

(AR) and Mixed Reality (MR). The use of MR technology and the growth of AR apps have created new avenues for the implementation of visual aids in the field of nutrition. A recent study assessed the effectiveness of a smartphone app that utilizes AR to scan food products and grade food products based on their healthiness according to FDA guidelines. The AR app then offers visual feedback, a thumbs up or thumbs down, color-coded according to the health evaluation, either as a static image or as an AR element. The study results showed that while both static images and AR were effective in nudging participants to pick healthier food options, participants expressed a preference for the AR feedback.[18] It indicates even though nudges may work in similar manners, the preference of consumers could be used as an incentive to ensure the consistent effect of the nudge.

With the capability to visually display nutritional information through simple designs in a mixed reality environment, nutritional knowledge becomes more tangible and easier for consumers to understand. This technology's growth creates a need for UX professionals to re-evaluate and adapt their strategies for these new tools.

In addition to design strategies that cognitively support consumers, also affective ones could be integrated in UX designs to influence consumers by making the healthier food options more appealing by enhancing their hedonic value.[19] These can also be achieved through descriptive texts, photos, visuals in digital environments. Among various ways to achieve the affective enhancement, a direct affective digital nudge is inviting people to pick the better option, for example by directly "speaking" with the consumer. In fact, in one study, participants who were accompanied by a virtual assistant in human-cartoon form with different facial expressions including surprised and neutral and a verbal message, while ordering high-calorie fast food products, ordered 208 calories less compared to the control group, and those in the color-coded intervention ordered 225 calories less compared to the control group. Moreover, combining the two strategies resulted in participants ordering 250 calories less, showing that while it is possible to benefit from one nudge, combining them could bring out even better results.[20]

In addition to traditional nutrition labels, there are various visual strategies that can be employed through digital nudges to improve the understanding of a product's nutritional value. These visual strategies not only complement traditional nutrition labels, but also address the limitations of nutrition labels, such as the complexity of calorie counting or nutritional information presented in a confusing format. Overall, digital nudges can play an important role in making nutritional information more accessible and understandable for consumers, ultimately promoting healthier food choices.

---

[18] P Jain, S Djamasbi, 'Transforming user experience of nutrition facts label-an exploratory service innovation study' [2019] International Conference on Human-Computer Interaction, 225-237.

[19] R Cadario, P Chandon 'Which Healthy Eating Nudges Work Best? A Meta-Analysis of Field Experiments' (2019) 39(3) Marketing Science, 465-486.

20 I Dolgopolova, A Toscano, J Roosen, 'Different Shades of Nudges: Moderating Effects of Individual Characteristics and States on the Effectiveness of Nudges during a Fast-Food Order' (2021) 13 Sustainability, 13347.

## 4. Conclusions.

The effectiveness of nutrition labels and their impact on consumer behavior towards healthier food choices has been a popular topic of research. Studies have shown that the interaction with nutrition labels can influence consumer behavior positively. The Nudge Theory explains the impact of nutrition labels on consumer behavior by suggesting that by making the better option more visible and salient, consumers are nudged towards healthier food choices. However, this effect is not homogenous among all consumers. Research indicates that consumer characteristics, such as socio-economic status, demographics, and health status, play a role in the effectiveness of nutrition labels. Likewise, there are prerequisites that need to be satisfied to guarantee the positive impact of nutrition labels, including the probability of a consumer reading and comprehending the label. The complexity of the label and the lack of a standard presentation format by food manufacturers are some of the hindrances to the effectiveness of nutrition labels.

Digital nudges, including those utilizing new technologies like AR and MR, might provide a quick personalized and adaptive approach to overcome these barriers and encourage healthy eating habits. UX professionals play a crucial role in designing digital nudges, integrating cognitive and affective strategies, and enhancing the interaction between consumers and nutritional information. To be effective, digital nudges should prioritize good usability and aim to provide a positive user experience that inspires healthy behavior. Utilizing visual aids, such as color coding, and incorporating affective strategies, like appealing photos and messages, can help make healthier food options more appealing and drive positive health outcomes.

This paper constitutes a preliminary look at another perspective on nutritional labels and suggest a new transformation from traditional methods to more innovative solutions that could suit various types of consumers. The purpose is to inspire the professionals to think in innovative ways while considering the consumer needs for good usability and invite researchers to expand their research to digital nudges and personalization of nudges based on consumer characteristics.