

FINs Visualization of the Nutrition Label

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1 OVERVIEW

Helping consumers choose healthy food is vital for public health, considering obesity and other diet-related issues have raised more concerns for society. Especially in areas considered to be 'food deserts,' neighborhoods in which healthy food is expensive and/or difficult to find[4]. According to a recent survey by the International Food Information Council Foundation [3], consumers are confused given the overwhelming amount of nutrition information around food choices. In particular, consumers tend to struggle when comparing products based on ingredients and nutrition.

Health labels are to help consumers understand the nutritional quality of food products and to improve purchase decisions regarding diet and health[6]. One of the deciding factors when selecting food items is knowledge about what nutrients are in them. Currently, in the United States, the Food and Drug Administration(FDA) regulates the design of the nutritional label and constantly works on improving its design to improve comprehension further. However, the current design is still complicated for consumers to interpret to make accurate comparisons between food products[11]. Notably, people tend to make mistakes when performing computations and estimating the contribution of a food product to their daily nutrient requirements. Additionally, since numeracy has proved to be essential in interpreting nutritional literacy[11], adults with a lower socioeconomic status(SES) can experience an increased misunderstanding of nutritional labels[1].

This study aims to answer the following question... *To what extent can a new interactive visualization of a nutritional label support comparison of products?*

We propose introducing a new visualization designed to support comparisons and make it easier to make diet-based decisions by allowing the consumer to recognize similarities and differences in products' nutritional labels easily. We want to assess three directions out of our new visualization: informed dietary decisions, better comprehension, and consumer's attitude when using this tool.

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1.1 *Informed Dietary Decisions*

When we say we want to build an interactive visualization that supports comparing products to promote informed dietary decisions, we want to help users accurately choose the best products for their diets. Since previous studies have shown that patients with dietary needs still struggle in understanding nutritional labels[11], we can assume this causes friction in choosing the best product for their dietary needs since comprehension of nutritional labels plays a massive factor in product decision-making[6]. In order to assess if our design supports informed dietary decisions, we look to answer the following research question:

RQ1: Can an interactive visualization nutritional label help consumers make more informed dietary-based decisions faster and more accurately compared to the original nutritional label?

1.2 *Comprehension*

There have been other studies attempting to create visualizations to illustrate the ingredients and nutrients within certain products[2, 5, 7, 9]. However, either these visualizations never completed a user study for comprehension, or they still possess confusion when completing the task of understanding the nutrient information per serving size or for the entire product. Notably, none of these visualizations were interactive for users; they were all static visualizations. Poor label comprehension associates with low-level literacy and numeracy skills, but even people with higher literacy skills still presented difficulty with food label comprehension. Within our interactive visualization, we want to illustrate nutrients and ingredients with less mathematical expressions needed to comprehend products' nutrition and an increase of graph-based visualizations that increase food label comprehension. To assess comprehension of our design, we ask the following question:

RQ2: Can comprehension of a nutritional label increase if the contents of the label were visually shown rather than numerically?

1.3 *Attitude*

Online grocery shopping can have a multitude of benefits, especially for those in low-income neighborhoods. Such as the potential to increase healthy choices via reduced unhealthy impulse purchases, nutrition labeling strategies, and can overcome food access limitations[8]. However, despite these benefits, the general attitude of online grocery shopping for participants with *Supplemental Nutrition Assistance Program*(SNAP) is still uninterested[10]. SNAP participants see the benefits of online grocery shopping but see no motivation to participate in their family's grocery shopping through an online environment. We want to see if an interactive tool that supports easier comparison of products can influence consumers' attitude towards online grocery shopping with the following questions:

RQ3: Can a tool that supports comparison between products change a person's attitude toward online grocery shopping?

RQ4: Can a tool that supports comparison between products motivate a consumer to use an online grocery environment more?

With these questions, we hope to create an interactive visualization design of the current nutritional label that can better support people's decision-making when comparing products based on nutritional contents, especially for low-income neighborhoods. In the remainder of this proposal, we describe our design choices as well as

design variations. Finally, we propose to conduct a preliminary study to test the user preference and performance of our design variations and compare them to the standard nutrition label.

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Authors, year	Title of Article	Objective/Aim	Design/Methodology	Key Points
Ozenak, K. 2020	How Online Grocery Stores Support Consumer Nutrition Information Needs	To see how accessible Nutrition Facts panel and Ingredient Statements were for consumer, and if there were any nutrition based attributes to filter through.	Surveyed 12 grocery store websites for Nutrition Facts/Ingredient Statements. Checked ability to filter search results for 7 specific health/nutrition attributes, and the ability to sort results by a nutrient	Food items that required nutrition information had it, but ease of access (one click away) and good legibility (blurry/small font) varied highly. Gluten-Free, fat-free and sugar-free were the majority option for filtered results, but no store provided the ability to sort results by a single nutrient.
Benn, Y. 2015	Online Grocery Shopping: promise and pitfalls for healthier food and beverage purchases	To understand what consumers look when online grocery shopping, and how they find it.	Eye tracking study of 40 participants while completing their weekly grocery shopping	Consumers tend to navigate through virtual departments rather than directly search for items. People also tend to pay more attention to pictures rather than detailed product information.
Jilcott Pitts, S. 2018	Online Grocery Shopping: promise and pitfalls for healthier food and beverage purchases	To identify potential promise and pitfalls that online grocery shopping may offer.	Systematic literature review of 24 relevant papers.	It has potential to increase healthier choiced through reduced unhealthy impulse purchases; however, it could also increase unhealthy choices because of hesitance to purchase perishables online.
Clark, L. 2007	Off Their Trolley -- Understanding Online Grocery Shopping Behavior	Created a framework designed to understand behavioural patterns and potential interaction problems.	Framework-based survey designed to examine the behaviour of online grocery shoppers in the UK.	There is considerable room for improving the user's experience when online grocery shopping, but their perception of control over their shopping is the most difficult challenge.
Harris, P.	Online and Store Patronage: A typology of Grocery Shoppers	To develop a typology of grocery shoppers based upon the advantages and disadvantages of shopping online and in store.	A survey design employed to 871 UK shoppers who has purchased groceries online and offline.	The choice of whether to shop online and in store suggests that the choice of whether is driven not by the perceived advantages of one, but by the desire to avoid the disadvantages of the alternative.
Mah et al.	A Visualization Fingerprint: Comparing Nutrient Data Visually	To create a visualization that supports comparisons and make it easier to recognize similarities and differences between products.	Created 3 different design iterations.	The visualization can support the comparison of two similar products visually and provides specific details via tooltips.
Machin et al. 2019	Do Nutritional warnings do their work? Results from a choice experiment involving snack products	To evaluate visual attention paid to nutritional warnings, and to assess the influence of nutritional warnings on consumers' food choices.	Eye tracking study of 199 participants where participants were asked to select a snack product off of a similar grocery store looking shelf to see which product they would choose.	50% of participants fixated their gaze on nutritional warnings. Between the two groups, when nutritional warnings were present, participants ended up choosing the 'healthier' option, where there's less warnings, lower sodium, saturated fat and sugar content.
Fenko et al. 2018	Does attention to health labels predict a healthy food choice? An eye-tracking study	To assess if higher visual attention to health labels plays a role in consumers choosing healthier choices.	An eye-tracking study to assess consumers' visual attention when having to decide between multiple products.	Label formats and time constraints influence visual attention, but visual attention towards health labels was a poor predictor of subsequent product choice.
Levine et al. 2012	Evaluating MyPlate: An Expanded Framework Using Traditional and Nontraditional Metrics for Assessing Health Communication Campaigns	To propose a framework for evaluating DGA communications initiative, including MyPlate and universal concepts that can be applied to other health communication efforts.	An evaluation of the framework that invites qualitative and quantitative research methods to measure both communications implementation and outcomes.	Suggests more attention is needed to overlooked measurement opportunities such as more focus on social norms, vulnerable populations, and expand the range of strategic analyses.
Schoessler, P. 2011	Feedback fridge: tangible visualization of nutritional data with preventive effect	To create a system that makes visualization of nutritional information tangible and more understandable to the user.	Created a system that consists of midrange radio-frequency identification reader that can read tags for up to 50 cm.	Combining existed RFID technology and tangible visualization of nutritional data can help individuals understand the relevance it has for their personal life.

Fig. 1. Summer literature Review

He et al.	Nutrition Bytes: Visualizing Food Content	To create an interactive visual representation of nutrient and ingredient information to support food decision making.	Employed Munzer's nested model to guide their design decision making throughout our user-centered process.	An informal paper prototype study indicated that users were able to answer the questions using their design. This design is a promising first step to represent nutritional information visually.
Cavaliere et al. 2018	Nutritional Labelling in the EU: Strengths and Weaknesses of the Current Regulatory Framework	To assess the current strengths and weaknesses that Nutritional Labelling can potentially help or dismay consumers	A framework-based survey to see how consumers interpret and understand nutritional labels	Consumers would benefit more from nutritional labels that ultimately facilitated consumers in interpreting nutrition facts and translating them into guidance for healthy food choices.
Rothman et al. 2006	Patient Understanding of Food Labels: The Role of Literacy and Numeracy	To examine patient comprehension of food labels in relation to their underlying literacy and numeracy skills.	A cross-sectional study of 200 primary care patients where a 24-item measure of food label comprehension was administered.	Poor label comprehension was highly correlated with low-level literacy and numeracy skills, but patients with her literacy still had difficulties interpreting labels.
Wan et al. 2018	Representing and Recommending Shopping Baskets with Complementarity, Compatibility and Loyalty	To create a new representation learning approach that leverages complementarity and compatibility holistically, as well as explicitly account for users' 'must-buy' purchases.	Evaluated representations from the learning approach and the recommendation algorithm on two public and two proprietary grocery shopping transaction datasets.	They created a novel approach and a learning approach that could be beneficial to our products when recommending healthier items to consumers.
Gollub et al.	Shaping the Information Nutrition Label	To create a visual representation of the nutritional label that categorizes original information nutrition dimensions, and interprets them in terms that are more understandable to the general public.	A preliminary crowd-sourcing study of the visual representation that matches their ideas.	Created 5 categories to characterize nutritional information dimensions: effort, kairos, logos, pathos, ethos.
Lytton, T. 2010	Signs of Change or Clash of Symbols - FDA Regulation of Nutrient Profile Labeling Symposium: The Future of Food Regulation	To show that the FDA's nutritional label can balance competing considerations to knowledge in areas of nutrition and food labels to help a public health strategy.	Using the current FDA framework to develop additional gradations of the FDA standard.	Nutrient profile labelling does not add confusion to consumers, but could have potential to help consumers become more aware of the standard for 'healthy' foods.
Blakova et al. 2013	Standing out in the crowd: The effect of information clutter on consumer attention for front-of-pack nutrition labels	To assess how information density affects a consumer's attention, information density including number and type of nutrition labels, chromaticity, number and type of additional design elements, distance between the label and additional design elements.	Visual search task study where attention was measured by performance through different levels of modulated by label type and chromaticity.	Information density is a key factor in regards to consumer attention to nutrition information, therefore design layouts should be optimized to help consumers easily find nutrition information on the front of the package.
Desrochers et al. 2015	The influence of product type, mathematical complexity, and visual attention on the attitude toward the website: The case of online grocery shopping	To assess the influence of product type, whether their search or experience, mathematical task complexity, and visual attention to product pictures, and to also evaluate consumers' attitudes towards the website.	A within-subject laboratory experiment of 32 students where each were asked to follow randomly ordered online grocery tasks. Then, they filled out a questionnaire after the experiment.	Visual attention has a positive effect on attitude toward the website when shopping for experienced goods. However, there was a negative effect on attitude when the arithmetic complexity is high.
D'Cosola III, B. 2020	Using Social Comparisons to Facilitate Healthier Choices in Online Grocery Shopping Contexts	To examine how to nudge consumers to make healthier food choices in an online grocery environment.	Pilot study that tests how social comparisons affect consumers' choices when grocery shopping whether they are more inclined to change their cart to reduce calories through an in-group or out-group comparison.	People who did not care for a new diet were more likely to reduce calories in their cart when present with an out-group social comparison. However, people wanting to diet reduced calories in their cart despite what social comparison was presented.

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 Fig. 2. Summer literature Review Continued