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Navigating the Nutri-Score: Inequidistant Perceptions of Front-of-Package Health Information

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ABSTRACT

The Nutri-Score is a front-of-package label designed to guide consumers toward healthier food choices, using letters A (indicating *high nutritional quality*) to E (indicating *low nutritional quality*). While many studies have assessed the impact on food consumption, little research has explored how the label is perceived. To address this gap, two online studies with representative samples from Germany investigated whether differences between neighboring Nutri-Scores are perceived as equidistant. Study 1 ($N = 562$) assessed perceived healthiness across the Nutri-Score scale, revealing a middle-of-scale effect, where differences between mid-range scores appeared larger than those at the extremes. Study 2 ($N = 319$) used a discrete choice experiment with products varying in price and Nutri-Score. While participants were more willing to pay for an improvement from C to B than from B to A, a different pattern emerged at the lower end of the scale, where consumers prioritized avoiding the lowest-rated products. These findings highlight the need for public education on the Nutri-Score's interpretation. They may also inform potential revisions to the label and contribute to broader public health strategies, such as food taxation policies.

1 | Introduction

The development of noncommunicable diseases such as ischemic heart disease, diabetes, and colorectal cancer is associated with unhealthy diets that are high in energy, sodium, sugar, and trans-fat while lacking fiber, vegetables, and fruits (Ezzati and Riboli 2013). As the consumption of unhealthy foods and beverages often exceeds dietary guidelines in many parts of the world (Aburto et al. 2022; Cohen et al. 2010), effects on morbidity and mortality are looming. For 2017 alone, 11 million deaths and 255 million disability-adjusted life years were attributed to unhealthy diets worldwide (Afshin et al. 2019) and a recent study from the United Kingdom estimated a 10-year increase in life expectancy following sustained shifts toward healthier diets (Fadnes et al. 2023). Previous research shows that unhealthy diets can be attributed to commercial, social, and individual factors. For instance, industry practices and insufficient regulation have increased the availability and affordability of highly processed food (Chung et al. 2022; Juul et al. 2022) while individuals often lack knowledge about its health risks, or skills to identify healthy alternatives (Carbone and Zoellner 2012; De Ridder et al. 2017). To inform and improve consumer choices, front-of-package nutrition labels have been introduced in many countries. While some labels indicate key information such as calorie count, sugar, or sodium content, others aggregate the nutritional information in a single score (Kanter et al. 2018). Based on evidence that traffic light systems can help consumers to identify healthier products (Ducrot et al. 2015, 2016; Hawley et al. 2013), several European

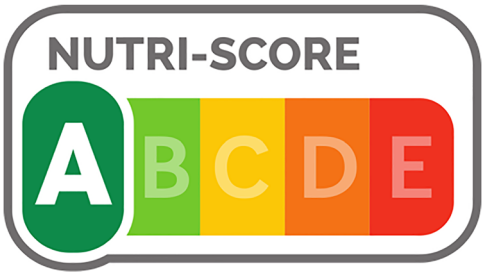

FIGURE 1 | Nutri-Score label of a product with rating A.

countries, including France, Germany, and Spain, endorsed the Nutri-Score, a color-coded scale from dark green (A, indicating *high nutritional quality*) to red (E, indicating *low nutritional quality*; see Figure 1), despite opposition from the agro-industry and retailers (Julia and Hercberg 2016). The calculation takes into account the beneficial and detrimental nutrients of a product. It is meant to allow comparison between products of the same category (e.g., comparison of two frozen pizzas); however, the current version of the Nutri-Score algorithm does not differ between product categories except for special rules for beverages, cheese, and added fats (Merz et al. 2024).

While surveys suggest that many people are aware of the Nutri-Score (Sarda et al. 2020), recent research investigated if the Nutri-Score affects product perception and choice as desired. In two studies from Belgium, the Nutri-Score enabled respondents to better assess the healthiness of products and, thereby, increased their purchase intentions (De Temmerman et al. 2021). Several other studies observed positive effects on product evaluation and choice in France (Courbet et al. 2024), the Netherlands (Van Den Akker et al. 2022), Switzerland (Egnell et al. 2020), and Morocco (Aguenaou et al. 2021). However, there have also been studies reporting little or no effects on product perception and choice (Castronuovo et al. 2022; Dubois et al. 2021; Vandevijvere and Berger 2021). The heterogeneity of results may be explained by methodological issues. For instance, Peters and Verhagen (2024) pointed out that studies supporting the Nutri-Score have often been conducted by authors involved in the development of the label and that evidence from real-life purchasing decisions is scarce. Furthermore, perception and use of the Nutri-Score relate to consumer knowledge and attitudes that were found to differ across European countries (Stiletto et al. 2023). For instance, influential government, industry and media stakeholders undermined public trust in the Nutri-Score in Italy, explaining why consumers disregard the label in their purchasing decisions (Fialon et al. 2022). While more research is needed to investigate contextual factors influencing the impact of the Nutri-Score, there is also value in better understanding the perception of the label itself. To date, little research has investigated if Nutri-Scores are understood as equidistant, that is, if the advantage of A over B is comparable to the advantage of B over C. This can help to better understand purchasing decisions and how they are affected by different parts of the label.

Technically, the Nutri-Score functions as a five-point scale. Research on Likert scales suggests that they are rarely perceived as equidistant. For instance, Lantz (2013) found an end-of-scale effect when only the endpoints of a five-point scale were labeled—perceived distances between scale points were greater near the end of the scale than in the middle. However, when all points were labeled, a middle-of-scale effect emerged, where perceived distances increased toward the center. A similar middle-of-scale effect may influence Nutri-Score perceptions, as each category is labeled with a letter. As a result, differences in perceived healthiness may be smaller at the extremes (A–B, D–E) than in the middle (B–C, C–D). This effect may be reinforced by the scale's color coding, as the two green and two red shades may be seen as more similar to each other than to the yellow category. Support for the inequidistant perception hypothesis also comes from prior literature on food categorization (Chernev and Gal 2010; Rozin et al. 1996); individuals tend to spontaneously categorize food as good or bad and Nutri-Scores in the same category (e.g., A and B as good scores) may be perceived as more similar compared to Nutri-Scores that appear to belong to different categories (e.g., B and C). To explore this further, two online studies were conducted to examine how Nutri-Score differences are perceived and how they affect product choices. Study 1 investigated whether differences in perceived healthiness are equidistant along the Nutri-Score scale, while Study 2 examined whether these differences translate into similar effects on product preferences. The findings provide insights into dietary decisions based on the Nutri-Score, informing educational efforts to improve public understanding of the label. They may also guide refinements to the underlying algorithm and other public health initiatives aimed at promoting healthier food choices.

2 | Study 1

Study 1 assessed the subjective healthiness of different Nutri-Scores to investigate if the underlying scale is perceived equidistantly.

2.1 | Method

2.1.1 | Participants and Design

The online study was conducted in January 2025 with 562 participants. The sample was recruited by a panel provider (Bilendi GmbH). It was non-probabilistic but quota-representative of the German adult population by age × gender. Participants ranged in age from 18 to 74 years ($M = 46.30$, SD = 15.17), with 51% female and 49% male. The majority of participants (56%) reported having university entrance qualifications, indicating better education compared to the general public. A within-participant design was used, in which participants rated the perceived healthiness of all five Nutri-Scores. The sample size was deemed sufficient to detect small effects when comparing differences in perceived healthiness between adjacent Nutri-Scores ($f = 0.1$, $\alpha = 0.05$, $1 - \beta = 0.95$).

2.1.2 | Materials and Measures

2.1.2.1 | Nutri-Score Awareness and Understanding. Participants were shown the Nutri-Score label and asked if they knew it (*yes* or *no*). To investigate if they understood the label correctly, participants were further asked what the Nutri-Score informs

about, using a single choice item with six possible answers (*how healthy the food is*; *how environmentally friendly the food has been produced*; *how much the food costs*; *how fair the conditions were under which the food was produced*; *how well the food's packaging can be recycled*; and *how many allergens the food contains*).

2.1.2.2 | Perceived Healthiness. Participants were shown each of the five Nutri-Scores in random order. They were asked to imagine shopping and seeing a product with the label. Afterward, they had to rate the healthiness of the product on a visual analog scale from 0 (*not healthy at all*) to 100 (*very healthy*). The original questionnaire is provided in the Supporting Information.

2.2 | Results

2.2.1 | Awareness and Understanding

A large majority of participants (91%) claimed to know the Nutri-Score, but only 70% correctly identified it as a label indicating the healthiness of products. For instance, 11% believed it represented the environmental impact of food, while 12% thought it signified fair production practices.

2.2.2 | Perceived Healthiness

As participants who did not know or understand the purpose of the Nutri-Score should be unable to rate a level of the label as more or less healthy, they were excluded from further analyses. For the remaining sample ($n = 381$), perceived healthiness decreased with worsening Nutri-Scores, and the average healthiness ratings for Nutri-Scores A and E did not reach the scale's minimum and maximum values (Figure 2). Importantly, an ANOVA indicated that differences between two neighboring Nutri-Scores varied significantly, $F(3, 1140) = 21.28$, $p < 0.001$. While Bonferroni-corrected *t*-tests (accounting for an increased chance of Type I errors) indicated no significant difference between the two end-of-scale differences A–B and D–E ($d = 0.08$, $p = 0.560$), the difference A–B was found to be significantly smaller than the differences B–C ($d = 0.29$, $p < 0.001$) and C–D ($d = 0.17$, $p = 0.006$), indicating a middle-of-scale effect.

As shown in Figure 2, some participants deviated from the general trend and perceived worse Nutri-Scores as healthier, indicating that they did not understand the label correctly.

2.3 | Discussion

Although the Nutri-Score is increasingly displayed on food products in Germany, our findings suggest that about one-third of the population do not know the purpose of the label, and even when they do, some seem to interpret the scale in the wrong direction. This lack of knowledge may be due to most packages missing additional information on how to understand the Nutri-Score. Packaging regulations requiring explanatory labels may help address this issue, while mass media campaigns could also improve public awareness and comprehension.

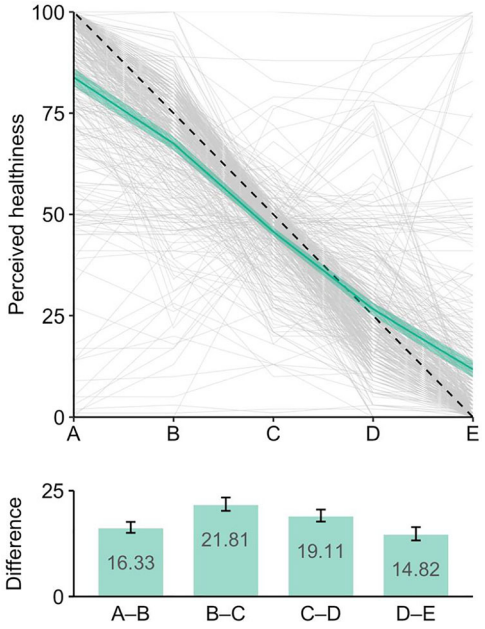

FIGURE 2 | Healthiness perceptions for Nutri-Scores A–E. The upper panel shows individual (grey) and average (green) healthiness perceptions (measured on a scale from 0 [*not healthy at all*] to 100 [*very healthy*]) of participants who knew and understood the Nutri-Score ($n = 381$). The lower panel shows average differences in healthiness perceptions between adjacent Nutri-Scores. 95% confidence intervals are indicated by the light green ribbon (upper panel) and error bars (lower panel).

While the Nutri-Score was designed to allow for relative comparisons of nutritional quality instead of absolute evaluations of healthiness, our results suggest that most people interpret the label in absolute terms by inferring high or low healthiness from a better (A) or worse (E) Nutri-Score. Importantly, healthiness perceptions of Nutri-Scores were not equidistant. The perceived health difference between two adjacent Nutri-Scores increased from the label's ends toward its center, suggesting a middle-of-scale effect similar to that observed in Likert scales where all points are specified (Lantz 2013). As proposed earlier, this effect may be driven by the Nutri-Score's colors, as light green B (orange D) may seem closer to dark green A (red E) than to yellow C. Indeed, a study from Schuldt (2013) showed that green nutrition labels increase healthiness perceptions and this may explain the closer healthiness ratings of Nutri-Scores A and B. The findings also relate to the spontaneous categorization of foods as good or bad (Chernev and Gal 2010; Rozin et al. 1996), which may reduce perceived differences between similarly colored Nutri-Scores.

Previous studies suggest that perceived healthiness depends not only on the Nutri-Score rating but also on other product attributes, such as food category, brand, or packaging (Fernqvist et al. 2024), and it remains unclear whether the middle-of-scale effect occurs in real-life product displays. In addition, it is uncertain whether differences in healthiness perceptions translate into similar differences in product preferences. If they do, individuals should be more willing to improve a product's Nutri-Score from C to B than from B to A—an idea tested in Study 2.

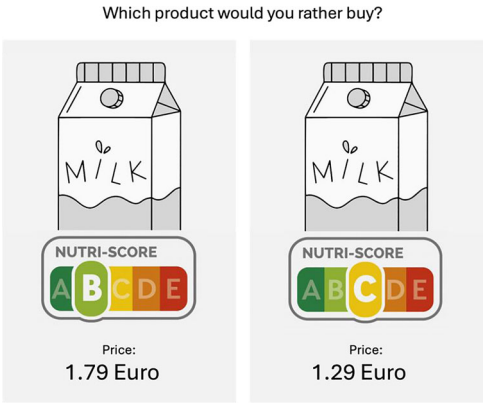

FIGURE 3 | Exemplary decision task. Translated from German, see Supporting Information for original material.

3 | Study 2

To examine whether the valuation of Nutri-Scores in product decisions follows the same non-equidistant pattern observed in healthiness perceptions, Study 2 employed a discrete choice experiment. In binary decision tasks, participants chose between two similar foods that differed in price and/or Nutri-Score. While other product features such as brand, packaging, or sustainability have been shown to influence food choice, price is usually ranked as more important by German consumers (Lebensmittelzeitung 2024). By focusing on Nutri-Score and price alone, a simple and efficient decision experiment could be designed that allowed us to assess the Nutri-Score's utility and compare the effects of different Nutri-Score improvements (e.g., from B to A vs. from C to B) on product choice.

3.1 | Method

3.1.1 | Participants and Design

The online study was completed by 369 individuals in December 2024. Participants were recruited by a panel provider (Bilendi GmbH). After excluding participants who reported not knowing the Nutri-Score, the final sample comprised 319 individuals. It was non-probabilistic but quota-representative of the German adult population by age × gender. Participants ranged in age from 18 to 73 years ($M = 45.84$, SD = 15.51), with 51% female and 49% male. The sample size was considered sufficient for the discrete choice experiment based on Orme's (1998) rule of thumb.

3.1.2 | Discrete Choice Experiment

At the start of the experiment, participants were asked to imagine shopping in a supermarket with two items left on their list: milk and chocolate. They then completed one block of 20 decision tasks for milk and one for chocolate (with block order randomized). In each decision task, participants were shown two milk packages or two chocolate bars that differed in price and/or Nutri-Score and had to choose which product they would prefer (see Figure 3 for an example). Milk products were assigned Nutri-Scores A, B, or C, while chocolate bars received Nutri-Scores C, D, or E. Prices for both categories were set at €0.99, €1.29, €1.59, €1.79, or €1.99. The chosen attribute levels were manipulated orthogonally and informed by products sold in Germany. Symbolic images were used to represent the milk containers and chocolate bars as depicting real products was expected to affect choice because of packaging and brand preferences, as well as product familiarity. Given the number of potential combinations, a fractional factorial design was realized. For each product category, 60 unique tasks were created; to minimize potential biases, 15 tasks varied only the Nutri-Score between the two options (e.g., decision between two milk packages with Nutri-Scores B and C but the same price of €1.29), 15 tasks varied only the price (e.g., decision between two milk packages with Nutri-Score B but different prices of €0.99 and €1.29), and 30 tasks varied both attributes, ensuring the product with the better Nutri-Score was more expensive (as shown in Figure 3). From the 60 tasks, 20 were randomly selected per participant to ensure the efficient and robust examination of product preferences.

3.2 | Results

For each product category, a multinomial logit model (Croissant 2020) was estimated to examine the effects of price (modeled as a continuous predictor in cents) and Nutri-Score (modeled as a categorical predictor with the best Nutri-Score as the baseline) on product choice. For milk (Table 1, Model 1), price had a strong influence on product choice, with the odds of selection decreasing by 3% for each 1-cent price increase. While Nutri-Scores had a smaller impact, their effects on product choice were not equidistant. Specifically, the detrimental effect of Nutri-Score C (compared to A) was more than twice as large as that of Nutri-Score B ($z = 7.71$, $p < 0.001$). This suggests that participants saw greater utility in improving milk's Nutri-Score from C to B (reflected in a willingness to pay of 31 cents) than from B to A (24 cents).

For chocolate (Table 1, Model 2), similar patterns emerged. Price strongly influenced chocolate selection, and while better Nutri-Scores increased the odds of product choice, their impact was not equidistant. Specifically, the detrimental effect of Nutri-Score E (compared to C) was more than twice as large as that of Nutri-Score D ($z = 8.94$, $p < 0.001$). This suggests that participants saw greater utility in improving chocolate's Nutri-Score from E to D (reflected in a willingness to pay of 34 cents) than from D to C (29 cents).

3.3 | Discussion

The discrete choice experiment revealed that participants were willing to pay higher prices for products with better Nutri-Scores. This aligns with a recent study from Italy in which consumers paid higher (lower) prices for better-rated (worse-rated) products when the Nutri-Score rating was visible (Stiletto et al. 2023). However, our experiment further indicated that the willingness to pay for the improvement of the Nutri-Score is not equidistant as participants were more willing to pay for improving the Nutri-Score of milk from C to B than from B to A. This aligns with the findings of Study 1, which found that perceived healthiness differed more between C and B than between B and

TABLE 1 | Predictors of product choice.

Model 1: Milk choice			Model 2: Chocolate choice		
Predictor	OR	95% CI	Predictor	OR	95% CI
Price (1 cent increase)	0.97	0.96–0.97	Price (in cents)	0.97	0.96–0.97
Nutri-Score B (compared to A)	0.42	0.38–0.47	Nutri-Score D (compared to C)	0.38	0.34–0.42
Nutri-Score C (compared to A)	0.14	0.12–0.16	Nutri-Score E (compared to C)	0.12	0.10–0.14

Note: Results from multinomial logit estimations. All predictors are significant with $p < 0.001$.

A. Interestingly, the studies diverged at the lower end of the Nutri-Score. While Study 1 found that perceived healthiness differed less between E and D than between D and C, the discrete choice experiment showed the opposite effect on product choice; on average, participants were willing to pay more to improve the Nutri-Score from E to D than from D to C. Although this result is based on hypothetical milk and chocolate bar purchases and may not generalize to other foods or real-life contexts, it suggests that the intention to avoid the worst Nutri-Score is not necessarily driven by expectations of significant health gains. Instead, other motives may be at play. For instance, social desirability could be a factor, as people may not want to be perceived as eating unhealthily (Huls et al. 2023). However, social desirability may be an artifact of the experimental setting, and further research is needed to explore the underlying mechanisms behind the findings.

4 | General Discussion

Two studies have shown that perceptions of the Nutri-Score are not equidistant. Perceived differences in healthiness increase toward the label's center, and there seems to be a particularly strong aversion to the worst Nutri-Score. However, the findings relate to German well-educated samples and may differ from real-life product perceptions and decisions, calling for replication studies that also control for product features beyond Nutri-Score and price, as well as consumer characteristics. For example, recent work indicates a complex interplay between the Nutri-Score and geographical indications, and consumers' income as well as their intentions to eat healthy or lose weight can moderate the impact of the label on purchasing decisions (Stiletto et al. 2023). If future research fortifies the observed effects, this may inform updates of the Nutri-Score, such as revising the label's coloring or algorithm. For instance, color differences between Nutri-Scores A and B could be increased to emphasize the health benefit of the best rating and push consumption intentions. Furthermore, the assignment of Nutri-Scores could be revised. For example, currently Nutri-Score D is assigned to products with a nutritional score ranging between 11 and 18. Relabeling products with a weak D to E (e.g., by assigning scores of 17 and 18 to E) may strongly improve avoidance of these products and increase the consumption of healthier alternatives.

The findings may also inform other measures to promote healthy nutrition such as food taxes. Our results indicate that the perceived benefit of buying a product with Nutri-Score A instead of B is limited compared to buying a product with B instead of C. However, Study 2 clearly showed that pricing affects product decisions, and reducing the value added tax (VAT) for products with Nutri-Score A could boost their consumption. VAT reductions for specific foods are already in place in many countries. For instance, in Germany, a reduced VAT rate of 7% applies to staple foods. Unfortunately, these include rather unhealthy products such as sausages or cheese, while much healthier foods like many plant-based products are often taxed at 19%. Linking the taxation of processed foods to their Nutri-Score (with A going tax-free and E incurring the maximum tax) could improve the effect of the label. This idea is also supported by recent research showing that differentiating VAT rates based on health considerations can support changes toward healthier diets (Springmann et al. 2025). However, in the short term, awareness, understanding, and trust in the Nutri-Score must be improved. According to Study 1, about one-third of the German population may not know the general function of the Nutri-Score and previous research indicates that many Europeans mistrust the label (Fialon et al. 2022; Stiletto et al. 2023). This calls for educational interventions addressing public concerns and explaining how the Nutri-Score can help individuals to adopt a healthier diet.

Author Contributions

Philipp Sprengholz: conceptualization, methodology, investigation, writing – original draft. **Anna Tabea Feifel**: conceptualization, methodology, writing – review and editing. **Babett Reich**: conceptualization, methodology, writing – review and editing. **Antonia Sahler**: conceptualization, methodology, writing – review and editing.

Ethics Statement

Both studies were conducted according to the guidelines of the German Psychological Association. Ethical clearance was obtained from the University of Bamberg's institutional review board (#2025-02/10), and all participants provided informed consent to use and share their data for scientific purposes without disclosing their identities.

Conflicts of Interest

The authors declare no conflicts of interests.

Data Availability Statement

The data that support the findings of this study are openly available in OSF at https://doi.org/10.17605/OSF.IO/EK3QP.

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