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CONSUMER PERCEPTION AND UNDERSTANDING OF NUTRI-SCORE LABELS

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Abstract

In the global context, unhealthy dietary habits significantly contribute to the risk of diseases and mortality. Recognizing this, the German Ministry of Nutrition and Agriculture prioritizes the promotion of healthier and balanced diets through its reduction and innovation strategy. Employing the Nutri-Score as a nudging tool, this study aims to assess the efficacy of visual nudging within the Fast-Moving Consumer Goods (FMCG) sector, specifically the food industry. The focus is on understanding consumers' purchase decisions influenced by the Nutri-Score and validating its consistency across various demographic factors. Utilizing an online survey with 294 participants, generating a total of 3,528 observations, the study explores participants' intentions to purchase selected products. Logistic regression analysis reveals that the Nutri-Score induces changes in purchasing behavior, with participants avoiding negatively rated products and preferring positively rated ones. Importantly, these effects remain consistent irrespective of participants' demographic characteristics.

Introduction

The integration of the Nutri-Score as a nutritional labeling system by the German government is a pivotal component of the national reduction and innovation strategy (NRI) aimed at curbing sugar, fat, and salt content in convenience foods. Officially registered with the European Union Intellectual Property Office (EUI-PO), the Nutri-Score has been in active use in German supermarkets since November 6, 2020 (BMLE, 2021a). Notably, other European countries, including France, Belgium, Spain, Luxembourg, and the Netherlands, have also adopted the Nutri-Score as a front-of-package label (FoPL).

As of now, the utilization of the Nutri-Score by food manufacturers in Germany remains voluntary, a departure from the labeling regulations set by the European Union (EU). Despite the EU Commission's decision in May 2020, in alignment with the "farm-to-fork strategy," to introduce mandatory food labeling, Germany has maintained its current approach (BMLE, 2020a). The introduction of Nutri-Score labeling aligns with the EU Commission's dual objectives: informing consumers about nutrient quality and incentivizing food manufacturers to enhance the nutritional quality of their products. Additionally, this labeling approach empowers governments to effectively implement health prevention strategies (WHO, 2021).

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This study delves into the familiarity and efficacy of nutrition labeling among German consumers, assessing its impact on product selection and its ability to promote awareness of a healthy and balanced diet—a primary goal outlined by the German Federal Ministry of Agriculture and Food (BMLE, 2021a). Specifically, the research scrutinizes the Nutri-Score's effectiveness as a visual nudging strategy in influencing purchase decisions. The investigation differentiates between the effects stemming from the mere presence of the Nutri-Score and those resulting from the Nutri-Score's expression through the evaluation of specific food items.

Materials and Methods

1.1. Nudging in the German Nutrition Policy

The German national reduction and innovation strategy is part of nutrition policy and is pursued in German consumer policy with the aim of reducing the proportion of sugar, fat, and salt in many convenience products by 2025. The German Ministry of Health is thus focusing on a holistic, sustainable nutrition policy that promotes a voluntary reduction strategy and provides consumers with a control instrument. Manufacturers can work voluntarily to adjust ingredients, and consumers have the opportunity to gradually reduce sugar content and become accustomed to less sweet foods (BMLE, 2021a).

Looking at national regulatory strategies of other EU countries, Denmark, Poland, Hungary, Finland, and France rely on additional food taxes in the form of sugar, fat, or other food taxes (Jatzke, 2018).

The former German Federal Minister of Nutrition (until 2021), Julia Klöckner, rejects an additional food tax such as a fat or sugar tax for Germany. Klöckner doubts that this tax can prevent malnutrition or overeating (BMLE, 2020b). For her, the focus of nutrition policy is on education and labeling of healthy and wholesome foods, considering the total number of calories (BMLE, 2023a). The current health minister, Cem Özdemir, is considering abolishing VAT on fruits, vegetables, and legumes, as food prices have risen sharply since the outbreak of the Ukraine war (Verbraucherzentrale Schleswig-Holstein, 2022).

Current German nutrition policy therefore does not envisage introducing or increasing food taxes but has opted for a nudging approach according to Thaler and Sunstein in the form of the Nutri-Score. The aim is to give consumers an easy-to-understand indication of the nutrient content of the product in question. Colors and a five-letter scale are used to indicate whether the product is classified as better or less healthy or unhealthy based on its nutrient composition (Figure 1).

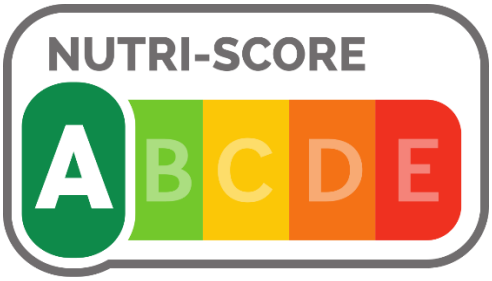

Figure 1. Nutri-Score
Source: BMLE (2021b)

In this context, the Nutri-Score serves as an incentive to positively influence the purchasing behavior of shoppers in grocery stores and to reduce the consumption of unhealthy foods in the long term, thereby reducing non-communicable diseases. The introduction of nutritional indicators raises public awareness and can influence consumer behavior.

In contrast to the human view of the classical utility theory, Homo Oeconomi-cus, where external influences do not change the purchase decision, the decision of Humans is very much influenced by external third party factors

(Thaler & Sunstein, 2022). The Nutri-Score with its rating scale provides such an external stimulus, which can simplify the decision situation and thus trigger heuristic information processing.

Consumers decide to buy a product, especially low-involvement goods, for emotional or heuristic reasons (Stopper, 2022). The packaging has a great influence on the decision-making process, since according to Lindstrom the sense of sight influences the purchase decision by 58% and a decision is made unconsciously (Lindstrom, 2005). Furthermore, 65% of purchase decisions are made spontaneously at the point of sale (Boldt, 2010). The Nutri-Score provides consumers with a visual stimulus, which leads to an influence on the purchase decision. In a consumer survey commissioned by the BMEL (Verbraucherzentrale Bundesverband, 2022), 90% of respondents described the Nutri-Score as "quickly and intuitively understandable". 85% think it helps "well in the comparison of different products".

At this point, it remains to be seen whether the use of the Nutri-Score is sufficient to change consumers' decisions in the long term to lead a healthier lifestyle or whether the introduction of the Nutri-Score needs to be supplemented by tax breaks for fruit and vegetables or price increases for unhealthy processed products.

1.2. Literature Review - Nudging and the Nutri-Score

The use of the Nutri-Score as a label on food packaging follows the principle of so-called nudging. The term nudging was introduced by Richard Thaler. He defines it as follows: "Nudge is any aspect of decision architecture that modifies people's behavior in a predictable way without prohibiting any option or substantially altering its economic incentive" Thaler and Sunstein (2009). Through a series of experiments, Thaler and Sunstein demonstrated that it is possible to help people make better decisions (Thaler & Sunstein, 2022).

People prefer the path of least resistance; the greater the effort required to perform a task, the less likely it is to be implemented. Nudging takes advantage of this fact by increasing or decreasing the potential for effort (Falvo & Urban, 2007). The use of a nudging strategy does not impose a constraint on the consumer. Neither is the consumer's decision making constrained or modified, nor are the economic incentives significantly altered. An important aspect of nudging is that individuals could make a conscious decision not to nudge. Since economic incentives are not affected by nudging, a traditional intervention in the form of a tax levy is not nudging. People are more likely to accept a nudge than tax policy approaches (Bruttel et al., 2014; Sunstein, 2016; Thaler & Sunstein, 2009). Compared to traditional regulations in terms of taxes and commandments or prohibitions, nudges are low-cost interventions that elicit less resistance from the public (Stopper, 2022). Visual nudging as a variant of nudging means that nudges are in the form of visual reference points such as food labels.

The Nutri-Score is part of a nudging strategy designed to guide consumers to compare similar products and perceive health-promoting products more positively (Stopper, 2022). In other words, the nudging approach forms a symbiosis of paternalism and liberalism. Consumers are encouraged in their decision for the better rated product, but do not lose freedom over their own purchase decision (Santos Silva, 2021).

It is not only since the development and introduction of the Nutri-Score that many nutritionists and economists have been concerned with the effectiveness of food labeling to improve consumer health. Regarding the Nutri-Score, there are already several sophisticated conceptualized studies, the most relevant of them are summarized in Table 1 listing as well their focus and the sample size implemented and their regional scope.

Table 1.
Literature Review - Nutri-Score

Authors	Results	Survey Size and Scope
Comparison of the Nutri-Score with other FoPL		
Aguenaou et al. (2021)	NS is most effective to properly classify the nutritional value of a product. The NS led to the food choice to the better rated product. The NS is the most popular and preferred compared to other FoPL.	Face-to-Face Survey N = 814 Morocco
Crosetto et al. (2020)	NS is most effective in making healthier food choices when comparing the 5 common FoPLs.	Field Experiment N = 691 France
Egnell et al. (2018)	NS has the highest effectiveness of all FoPL, in reducing portion sizes for products with a negative NS ranking.	Online Survey N = 25,772 France
Drexler and Freiberger (2021)	Function and added value of the NS and influence on purchase decision. Results: NS is easy to understand, provides added value to consumers. NS greater support than nutrition table. Facilitates purchase decision and influences it positively.	Online Survey N = 128 Germany
Fialon et al. (2022)	NS is easier to understand, use and to make a purchase decision faster compared to NutrInform. NS is most helpful to understand the nutritional quality of the product.	Online Survey N = 1,064 Italy
Finkelstein et al. (2019)	Using the NS compared to Multiple Traffic Lights statistically resulted in healthier food purchases.	Online Experiment N = 154 Singapore
Gassler et al. (2022)	NS allows for better food choices, especially for consumers who are overwhelmed with the standardized nutrient table. NS serves as an aid to distinguish products in a product line in terms of unhealthy nutrient profiles.	Online Survey N = 474 Germany
Julia et al. (2017)	The NS is the most popular of the 5 common nutrient labeling models and has the widest reach for making nutritional recommendations.	Online Survey N = 14,230 France
Julia and Hercberg (2017)	Comparison of effectiveness of NS with other FoPL FoPL such as 5-CNL, Health Star Rating System (HSR), Multiple Traffic Lights (MTL), GDA/RI, SENS. NS is the most effective method of visual nudging.	Online Survey N = 14,230 France
Comparison of the Nutri-Score with other FoPL		

Jürkenbeck et al. (2023)	Organic seal and NS have their market justification. NS is also important for consumers in organic labels and is not evaluated as contradictory.	Online Experiment N = 11,981 France
Liljeberg and Krambeer (2019)	Compared to other nutrition labeling models, NS is the easiest to understand, popular and serves as a good first orientation regarding a healthy eating style.	Online Survey N = 1,201 France
Fialon et al. (2023)	NS increases consumers' ability to identify healthier foods in a product category compared to NutriInform.	Field Experiment N = 1,668,601 France
Marcos et al. (2023)	FoPL information and design have an impact on purchase decisions.	Online Survey N = 1,059 Portugal
Talati et al. (2019)	High demand for food labeling. The comparison of the 5 FoPLs showed that the colored FoPLs (MTL and NS) were the most popular. Overall, the MTL is the most popular labeling. However, the NS is not represented in all countries.	Online Survey N = 25,772 France
Oeschger (2019)	FoPL help consumers make healthier purchasing decisions? The NS is the most effective form of FoPL.	Online Survey N = 774 Switzerland
Nutri-Score and Health Impacts		
Deschasaux et al. (2020)	High consumption of foods with a negative NS (or nutritional index value) is associated with increased mortality due to diseases such as cancer, circulatory and respiratory diseases	Online Survey N = 521,324 10 EU countries
Ducrot et al. (2022)	Almost all adolescents (11-17) know, understand, and use the NS, and 50% of adolescents reported being influenced by the NS when shopping for food. Results have shown that parents transfer their eating behaviors to their children. Consideration of NS is more likely to result in adolescent behavior change related to food.	Online Survey N = 1,201 France
Dubois et al. (2021)	NS is most strongly associated with healthier food choices.	Offline Experiment 60 Supermarkets N = 1,668,601 France
Egnell et al. (2022)	NS favored the purchase of healthier foods for individuals with cardiometabolic chronic conditions.	Online Experiment N = 1,180 France

Müssig (2019)	The use of FoPL results in fewer people dying from chronic conditions. The use of NS prevented 3.4% of all deaths that were due to poor diet.	Offline Experiment N = 45,314 France
Impact of the Nutri-Score on the Purchase Intention		
Ducrot et al. (2016)	The NS improved the quality of the whole purchase of the customers most effectively	Online Experiment N = 11,981 France
Egnell et al. (2019)	The NS improved the quality of customers' overall purchasing most effectively.	Online Experiment N = 2,907 France
Egnell et al. (2021)	The NS improves the quality of the customers' total purchase most effectively. The purchase of processed products decreases with the NS and the proportion of unprocessed foods increases.	Online Experiment N = 1,866 France
Szabo de Edelenyi et al. (2019)	The classification of food products according to the NS was in line with the German FBDG. The recommended products were ranked more popular than those that should be restricted.	Online Survey N = 8,587 Germany
Impact of the Nutri-Score on the Purchase Intention		
Temmerman et al. (2021)	Health-related products could be better rated by NS. Intention to buy healthier food products increased.	Online Survey N = 303 Belgium
van den Akker et al. (2022)	Positively rated FoPL leads to an increase in the purchase decision. But not to an increase in the consumed portion size.	Field Experiment N = 300 Netherlands
Ineffectiveness of the Nutri-Score		
Folkvord et al. (2021)	The NS has no influence on the consumers' taste perception, attitude, and purchase intention.	Online Experiment N = 192 Netherlands
Thomas et al. (2022)	The NS is still insufficiently known among the population. According to the survey, the most common reasons for a product decision were packaging design, price, brand familiarity and only at the end the NS.	Face-to-Face Survey N = 100 Germany
Zeder et al. (2022)	The NS did not lead to a purchasing behavior from which an improved energy or nutrient intake could be derived. The traffic light system was not intuitively recognized and understood.	Online Survey N = 104 Switzerland
Potential Moderators of the Effect of the Nutri-Score on the Purchase Decision		

Aschemann-Witzel and Hamm (2010)	Age and gender have no influence on the purchase decision.	Offline Experiment N = 210 Germany
Ares and Gámbaro (2007)	The differences in purchasing behavior between the sexes in developed countries are smaller.	Face-to-Face Survey N = 200 England
Bakshi (2012)	In addition to different expectations, desires, needs, lifestyles, etc. Gender plays an important role in the purchase decision.	Literature Review
Missagia et al. (2013)	Healthy eating is interpreted differently by the sexes and can therefore lead to different purchasing behavior.	Online Survey N = 309 Brazil
Potential Moderators of the Effect of the Nutri-Score on the Purchase Decision		
Prättäla et al. (2006)	Research has shown that differences in purchasing behavior are because social norms, cultural beliefs, motivations, and targeted marketing strategies influence purchasing behavior differently between genders.	Offline Survey N = 25.094 Finland, Estonia, Latvia, Lithuania
Rani (2014)	Age is a major factor in influencing buying behavior through marketing strategy. Consumption decisions, behaviors, habits, and patterns differ with age.	Literature Review
Sarda et al. (2020)	NS has greater significance for younger individuals.	Online Survey N = 4,006 France
Slabá (2019)	Age generally has an influence on purchase decisions.	Survey N = 350 Czech Republic
Christoph et al. (2018)	Use of nutrition labels is more common among women with high education and income.	Online/Offline Survey N = 1,817 USA
Ducrot et al. (2015)	Individuals with lower levels of education, who are not as good at judging the nutritional quality of a food, are more likely to use the NS.	Online Survey N = 14,230 France
WHO (2021)	In low-income households, the NS performed best of all FoPLs:	Literature Review

Summarizing, the results from the table indicate that at least for central Europe, where it also is the most present, the Nutri-Score can be considered the most efficient FoPL. Studies focusing mainly on French customers strongly indicate that the presence of the Nutri-Score leads to healthier consumption choices by the customers.

Considering the small number of observations in those studies that do not find a significant impact of the Nutri-Score as compared to the large-scale experiments and surveys that report an impact by the Nutri-Score on purchase decisions it can be conjectured that the Nutri-Score indeed emits a positive effect of consumers' purchase decisions.

The main downside to all these studies, however, is that they do not differentiate between the effect the mere presence of the Nutri-Score has on customers' purchase decisions and the effect emitted by the scoring the Nutri-Score displays. This disaggregation of the Nutri-Score's effect on customers' purchase decision will thus be the main objective of this study.

1.3. Research Hypotheses

The results of the studies presented in the previous section suggest that the Nutri-Score has an influence on the purchase decision. This influence can take place on two levels. First, the mere presentation of the Nutri-Score, independent of the respective evaluation, as FoPL can influence the purchase decision. This results from the consideration that consumers can better assess the quality of products through the Nutri-Score (Temmerman et al., 2021; van den Akker et al., 2022). This leads to the first research hypothesis of this study:

1.3.1. Hypothesis 1

• H1: The Nutri-Score as a visual stimulus, by its mere presence, influences consumers' purchase decisions independent of their own preferences.

The Nutri-Score as a visual stimulus, by its mere presence, influences consumers' purchase decisions independent of their own preferences. In addition to the effect resulting from the presence of the Nutri-Score, an effect can also be hypothesized that results from the evaluation displayed by the Nutri-Score. Referring to the discussion of visual nudges, it can be assumed that a positive Nutri-Score leads consumers increasingly to a positive purchase decision, while a negative Nutri-Score leads increasingly to a negative purchase decision. This can be expressed compactly by the second hypothesis:

1.3.2. Hypothesis 2

• H2: The better the Nutri-Score, the more positive the consumer's purchase decision will be.

The better the Nutri-Score, the more positive the consumer's purchase decision will be. In the last part of Table 1, potentially relevant moderators such as, age, gender, education, and income, were discussed as an influencing factor for a general purchase decision. Based on the existing research, it can be accepted that there is an effect of age and gender on the purchase decision. In the research, not only the influence on food was investigated, but the general willingness to buy goods. In view of the given information, the following hypothesis is postulated:

1.3.3. Hypothesis 3

• H3: The effect of the Nutri-Score as a visual stimulus on the purchase decision will be reduced by controlling for the socio-demographic characteristics age and gender.

The effect of the Nutri-Score as a visual stimulus on the purchase decision will be reduced by controlling for the socio-demographic characteristics age and gender.

1.4. Research Design

The data required to test the hypotheses formulated are collected by means of an Internet-based survey. A standardized questionnaire not only allows statistical evaluation of the data collected and thus the application of the necessary tests, but also enables the recruitment of a larger number of test persons. The decision was made in favor of an Internet-based survey instrument, since with a penetration rate of over 90% in Germany there is no

significant exclusion criterion and the advantages of the instrument over a written or face-to-face survey predominate, the absence of interviewer effects and the anonymity of the participants.

The implemented questionnaire is composed of three thematic blocks with a total of 24 questions. To familiarize the subjects with the topic, it is first elicited how familiar they are with the Nutri-Score.

The main part of the experiment takes place in the middle part of the survey. The subjects are presented with pictures of foods from different categories; in this study the results for frozen pizzas and mueslis are considered as they cover significantly different areas of the nutritional spectrum and in part target different groups of consumers. In a first round, three pictures of the respective food item were shown without a Nutri-Score label and in the second round with a Nutri-Score label as a purchase option. The subjects had to choose between these three items in each round.

Depending on the perspective, this experiment structure can be interpreted as a special type of discrete choice experiment with a $2^2 3^1$ structure consisting of the three attributes Nutri-Score (2 levels: displayed, not displayed), Rating (3 levels: A good, C neutral, E bad), Product Type (2 levels: pizza, muesli). A fallback option, in which subjects can decide against all three options, was avoided to enforce a clear decision. Considering the number of observations this experimental structure leads to a multiplier of twelve regarding the number of observations maximally available for analysis.

The clearest criticism of this experimental structure lies in the fact that no actual purchase decision is made, but only the purchase intention of the test persons is surveyed, which can be additionally distorted by the forcing of an answer. However, with recourse to the Theory of Planned Behavior according to Ajzen, it can be argued that there is a strong correlation between a purchase intention and the actual purchase decision, so that a bias due to the presence of an attitude-behavior gap (Sheeran & Webb, 2018) in this direction can be eliminated (Ajzen, 1991; Ajzen & Fishbein, 2010). A bias due to the lack of an avoidance option can be faded out as well, since the experiment is primarily interested in the change of the choice made, but not in the choice itself. Since both questions follow each other directly and the representations differ only by the Nutri-Score, changes in the decision can be directly attributed to the presence and expression of the Nutri-Score.

The survey concludes with questions on the sociodemographic background of the subjects, including age and gender.

2. Results

2.1. Description of the Sample

A total of 463 subjects participated in the survey. After adjusting the data set for incomplete, abandoned or incorrectly completed questionnaires, 294 subjects remain who completed the entire questionnaire. Table 2 is showing the information of the demographic information of the participants.

In terms of the age of the participants, the median age is 37 years, and the mean is 35 years. The youngest participant was 17 years old, the oldest 75 years. In relation to the German average of just over 44 years, this represents a somewhat younger sample.

The level of education is relatively evenly distributed, except for one person with a doctorate. Slightly more than half of the respondents have a university degree (31% master's/diploma, 26% bachelor's, 1% doctorate). This does not correspond to the educational level of the overall population in Germany, with 33.5% having a school-leaving certificate (Abitur), 46.6% vocational training and 18.5% a university degree (Destatis, 2020). When asked about their personal perception of their financial situation, 65% said they were rather well off, 29% very well off and the minority said they were financially poor (5% rather poor and 1% very poor). This corresponds well with the distribution of education levels and is equally at odds with the German average, where 32% are concerned about their financial security.

Table 2.

Participants´Demographic Information from Survey

Demographic information	**Median**	**Mean**	
Age	37	35	
	Female	**Male**	
Gender	54,18%	45,81%	
	Vocational training	**High school**	**University degree**
Education	46.6%	33.5%	31%
	Very well off	**Well off**	**Financially poor**
Financial situation	65%	29%	6%

Source: Own Conception

In summary, it can be stated that the sample tends to be younger and more highly qualified than the German average. On the one hand, this may be due to the medium of the online survey. On the other hand, it can be attributed to the fact that the younger society is more interested in sustainability and healthy nutrition. This is supported by the fact that 42% of the respondents stated that the Nutri-Score and corresponding seals of approval rather influence their purchase decision than the price. Furthermore, it can be seen from Table 3 that the majority also stated that they prefer healthy foods (Avg: 1.69) and avoid convenience foods (Avg: 1.74). Looking at the awareness towards the nutrient table on the packaging (Avg: 2.41) and the nutrition composition (Avg: 2.47), the tendency is that there is awareness among the participants. However, the Nutri-Score does not help most participants in evaluating the nutritional composition of a product (Avg: 2.7). The Nutri-Score is not used among participants to compare products from the same product line (Avg: 3.07). However, predominantly the participants stated that they will pay attention to the Nutri-Score in the next purchase (Avg: 1.85). This also fits with the statement that the majority would rather not buy a negatively rated product (Avg: 2.62). Thus, although the sample used is not representative of Germany as a whole, it is very much representative of the part of society that is more open to the issues addressed by the Nutri-Score. When asked about the Nutri-Score, 73% stated that they were already aware of the Nutri-Score and knew about its importance.

Table 3.

Participants' Answers on Survey Questions

Question	**Average**	**Median**
Do you pay attention to the nutrition table on the back of the package when you shop?	2,41	2
Do you pay attention to the nutrient composition of the product?	2,47	2
Do you pay attention to the price when shopping?	2,24	2
The Nutri-Score helps me to evaluate the nutritional composition of the product?	2,7	3
I use the Nutri-Score to compare products of the same category.	3,07	3
The product you want to buy is negative ranked by the Nutri-Score. Do you buy it?	2,62	3
Will I look out for the Nutri-Score in my next purchase	1,85	2

Notation: (1 – Fully agree / 4 – Fully disagree)

Source: own conception

Table 4 also shows how the subjects interpret the interplay between price and Nutri-Score assessment for themselves and the extent to which the two variables influence the purchase decision. A comparison of the key figures shows that there is no major difference between the perceived relevance of price and Nutri-Score. This shows that despite a mean value of 2.2, which is below the theoretical mean value of 2.5, the Nutri-Score plays a significant role in the purchase decision. This statement is supported by the fact that most of the subjects stated that they would not purchase a product if the Nutri-Score was poor (Avg: 2.62).

Table 4.

Impact Of The Nutri-Score On The Decision-To-Buy

Question	Average	Median
Assuming the price of a negatively rated product increases, would you still buy it?	2.82	3
Does the Nutri-Score speed up your purchase decisions?	2.20	2
Does the price speed up your purchase decisions?	2.27	2

Notation: (1 – Fully disagree / 4 – Fully agree)

Source: Own Conception

In the following section, the statement is examined in a little more detail by testing the hypotheses.

2.2. Hypotheses Tests

To test the hypotheses mentioned above, a logistic regression is used. As explained in the methodological section, the experimental structure can be interpreted as a discrete choice experiment, where the dependent variable indicates which of the displayed items the test person chooses. Here, the negatively rated item was set as the reference, i.e., only variables for the neutral and good rating are used in the model to avoid multicollinearity. Table 5 summarizes the results of the estimation, whereas Model I and Modell II are the reference models where only a single type of food, pizza, and muesli, are considered. Model III is the reference model where the observations for both types of food were pooled; differences between the two types of foods are captured by the variable type of food. Model IV is the implicit robustness check introducing age and gender as additional control variables. The behavior change variable (1= Nutri-Score is displayed / 0= Nutri-Score not displayed) describes whether the presence of the Nutri-Score on a food item per se influences the purchase decision. Its significance level thus provides information on the validity of hypothesis 1.

The first hypothesis focuses on the relevance of the Nutri-Score independent of the respective score presented. Since the parameter for the behavior change variable is significantly different from zero across all four models ($p < 0.001$), the hypothesis can be accepted.

Regarding the second hypothesis, it is important to note first that the hypothesis assumes that the coefficient is positive both variables introduced into the model since the negatively rated food item is considered as reference; a more positive Nutri-Score thus leads to a positive behavior change. It can be assumed that the effect will be stronger in absolute terms with respect to the positively rated food item.

It is precisely this effect that is reflected in the results as summarized in Table 5. Both coefficients, for the neutral and for the positive Nutri-Score, are highly significant, as previously noted, and report a positive sign. In the case of the neutrally rated item, the coefficient is much weaker, 1.262, than in the case of the positively rated Nutri-Score, 3.654 (Model III). It can additionally be noted that the difference between negative and neutral NutriScore with a value of 1.262 is much smaller than the difference between the positive and the neutral Nutri-Score with a value of 2.392 (1.262 – 3.654). Thus, it stands to reason that the Nutri-Score rating has a monotonic almost

exponentially positive effect on purchase intention which affirms its relevance as the most prominent FoPL. In summary, this means that the second hypothesis can be considered confirmed.

This effect can be explained, among other things, by the fact that consumers are more likely to distrust extremely negative ratings (Crowley & Hoyer, 1994). It can also be assumed that the result is because consumers are not guided to the same extent by the Nutri-Score in the case of a very negative evaluation, but instead resort to further brand knowledge or subjective assessments of the products.

Table 5.

Regression Results Multinomial Logistic Regression

Variable	**Model I (Pizza)**	**Model II (Muesli)**	**Model III (Both products)**	**Model IV (Both + Robustness)**
Constant	-0.693***	-0.693***	-0.693***	-0.693***
	(0.071)	(0.071)	(0.064)	(0.216)
Behavior Change	-2.098***	-1.822***	-1.951***	-1.951***
	(0.260)	(0.233)	(0.173)	(0.173)
Neutral Nutri Score of C	1.492***	1.046***	1.262***	1.262***
	(0.287)	(0.267)	(0.195)	(0.195)
Good Nutri Score of A	3.775***	3.551***	3.654***	3.654***
	(0.282)	(0.258)	(0.190)	(0.190)
Type of Food	-	-	0.000	0.000
			(0.079)	(0.079)
Age	-	-	-	0.000
				(0.004)
Gender	-	-	-	0.000
				(0.083)
N	1,764	1,764	3,528	3,528
Nagelkerke Pseudo R^2	0.246***	0.247***	0.246***	0,246***

Notation: The reference category is the item with a negative Nutri-Score of E // * - significant at the 10% level; ** - significant at the 5% level; *** - significant at the 1% level

Source: Own Conception

The third hypothesis postulates that the Nutri-Score affects consumers depending on their gender and age. To test this hypothesis, the results of Model IV are compared with the original Model III from Table 5. Since the coefficients for behavior change (-1.951; -1.951) and the two Nutri-Score ratings (Nutri-Score C 1.262; 1,262 and Nutri-Score 3.654; 3.654) are not different between the two models and neither gender nor age (0.000; 0.000) have a significant impact on the intention to buy, it can be conjectured that the Nutri-Score's effects are independent of both socio-demographic factors age and gender.

Accordingly, a mediating as well as a moderating effect of gender and age within the model can be ruled out and the third hypothesis must be rejected.

3. Discussion and Conclusion

3.1. Insights Gained

With regard to the German national reduction and innovation strategy, the Nutri-Score was introduced in German supermarkets in 2020 (BMLE, 2021a). The background of the study was to check the effect of the mere use of

the Nutri-Score as well as the respective expression in the form of the presented rating. For this purpose, low involvement goods such as pizza and muesli were selected and the purchase decision without Nutri-Score and with Nutri-Score were compared.

An awareness of food labeling is already widespread and the Nutri-Score as a seal is known to consumers. In the survey, 73% of the participants have confirmed to know the Nutri-Score. However, only 26% of the participants stated that they use the Nutri-Score to compare products from the same product category and thus it plays a predominant role in their purchase decision. In addition, the responses indicate that the level of awareness of the Nutri-Score is higher than the usefulness of it. Nonetheless, 44% indicated that the Nutri-Score helps in evaluating the nutritional composition of a product. Thus, it has been shown that the Nutri-Score can influence consumer purchasing behavior simply by its presence, and this is independent of the gender and age of the participants.

With the display of pizza and muesli without and with Nutri-Score was shown, that a positive Nutri-Score has an attracting effect on consumers. It was shown that if the Nutri-Score becomes better the attractiveness of the respective item increases over linearly strong, i.e., potentially in an exponential manner. Like the results for the Nutri-Scores presence on consumers' perceptions the effects of its rating also are not affected by the participants' gender and age.

3.2. Policy Recommendations

Based on the previous and extended research results, the most important finding is that the Nutri-Score is a useful nudging strategy to influence consumers' chewing decisions. Looking at existing research that compares different FoPL with Nutri-Score, it is clear that the NutriSore is the most effective and the easiest FoPL for consumers to understand.

The current German national reduction and innovation strategy has a voluntary policy and does not force manufacturers to use the Nutri-Score as a packaging label. In general, the use of the Nutri-Score is free of charge for all food manufacturers and according to the BMLE, about 610 companies with 970 brands are already registered to use the Nutri-Score (BMLE, 2020b). This study shows for Germany that the Nutri-Score is an effective and cost-efficient tool for positively influencing purchasing behavior. Looking at the other countries that have also established the Nutri-Score in their national supermarkets, these are not mandatory in any of the countries, but on a voluntary basis (BMLE, 2021b).

However, the Federal Ministry of Health should keep in mind that regardless of gender, age, or other sociographic factors, there will be people who will not choose healthier products despite understanding the Nutri-Score. Thus, psychological factors such as attitude and perception at the time of purchase may also have an unpredictable influence on the purchase decision. In particular, impulsive or habitualized behavior are difficult to predict and even more difficult to influence (Ajzen, 1991). Accordingly, a multidimensional strategy on the part of the BMLE is necessary to achieve the best possible results.

A voluntary reduction strategy can be very time consuming and will not motivate all food manufacturers to change their recipes and production lines. Therefore, another possible approach would be to subsidize companies that reduce sugar, salt, or fat content by a concise percentage.

Investment programs for agriculture are already planned with a budget of € 816 million until 2024 to support the improvement of agricultural services (BMLE, 2021c). To motivate producers to make their products healthier, subsidies play an important role. It is important to consider the value chain of a produced product holistically and to subsidize the stations of the value chain that are trivial for a production of healthy food. Thereby, not powerful conventional agricultural large-scale enterprises and landowners should be subsidized, if they reduce the sugar, salt, or fat content. The German government with its targeted actors and stakeholders can´t agrees on a targeted

approach. Therefore, it must be carefully decided who of the value chain of the production will be subsidized and who feel the need to take the step for healthier manufacturing. (BMLE, 2021c) (Robert Bosch Stiftung, 2021)
The health authorities in the countries where the Nutri-Score is established have agreed on a change in the calculation of the Nutri-Score values and will therefore implement the newly developed algorithm as of December 31, 2023. This is to be adapted by the food manufacturers in the next two years. This change was decided in order to make it easier for buyers to choose healthier foods (BMLE, 2023b). This adjustment could better help consumers in their shopping choices and thus also provide greater confidence in the Nutri-Score.
To further raise the awareness of the public, in addition to a mandatory introduction of the Nutri-Score, the population should be educated more strongly and as early as possible. At primary and secondary schools, an understanding of what the Nutri-Score as a seal says and how it is to be interpreted can be generated through educational strategies or marketing strategies such as television commercials, posters, and social media, such as TikTok, Instagram and YouTube.
The last point is even more important because the Nutri-Score offers companies several opportunities for health-related greenwashing. Since the Nutri-Score is determined according to a set of rules based on limit values for individual food components and additives, companies can specifically influence individual components and ingredients of their products without necessarily bringing a healthier product to market. Accordingly, there is a need for action on the part of the German government to prevent or at least restrict such behavior on the part of companies.

3.3. Limitations and Outlook

In addition to the socio-demographic factors studied, age and gender, other factors such as educational level or income, or environmental factors such as the general social situation, cultural background, or the influence of social expectations through family and friends, can also be considered and help the German health strategy to develop different customer profiles and appropriate policies.
In addition, it could be useful to review how different age groups make purchasing decisions. While the study found that age has an impact on purchase decisions, it remains to be seen to what extent the postulate about the effect of age on the presence of established consumption patterns is tenable. In this case, more targeted marketing strategies can be initiated by the government.
Future research could also include insights into German culture to increase the validity of the study and achieve better results.
When presenting the sample, it was pointed out that it is on average a younger and better educated group than would be the case if it were representative. Here, future surveys should not only choose a broader data basis but should primarily aim at a general representativeness with respect to the entire German population. A comparison of different cultural regions within the EU also seems to be a promising research approach to evaluate the effectiveness of the Nutri-Score as a European policy instrument.

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