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# Title: Preference for Nutritional Quality Attributes of Bread: Evidence from young consumers in Germany

**Abstract**

The past few decades have shown that consumers' concerns about nutrition and healthier lifestyles are changing both their food purchasing intents and perception of food quality. This study aims to analyze the effect of health information on the preference and willingness to pay for whole grain bread. Our experimental design utilizes the conditional exchange algorithm to generate optimal choice sets based on the bread attributes – price, grain type, and nutrition information. With a focus on students from the University of Göttingen, our empirical results find that on average, the treatment (health information) is associated with a higher preference for whole rye grain bread and a lower preference for whole wheat grain bread. Also, international students maintained a strong dislike for whole grain bread, despite the treatment which is attributed to their level of familiarity. The study further finds that there is a higher preference for nutritional information, for respondents with a higher income level. Our findings imply that policy on health information requires consideration on the background of the audience, level of familiarity with bread type, and income level.

**Keywords: Willingness-to-pay, Choice, Experiment, Attributes, Bread**

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## 1. Introduction

Bread and man have a long relationship that dates back more than 4,000 years. Bread has been a well-liked staple food for people across the world, though not necessarily in the same form or as we know it today. Bread is globally relevant in international nutrition due to its practically universal consumption (Cauvain, 2004). Germany has a strong tradition of bread. Compared to most other nations around the globe, Germans consume more types of bread and have more bakeries. There are currently more than 3,200 types of bread that are recognized as official in the country, and the German bread culture was formally added by UNESCO to its Intangible Cultural Heritage list in 2015.

In recent times, food quality has become a major concern in modern food economics and the past few decades demonstrate dynamic changes in people's food purchasing intentions, habits, and preferences. The consumer of the twenty-first century is a very demanding one, showing more interest in product quality and health advantages (Sajdakowska et al., 2018). Although bread consumers have embraced a wide range of bread types and variants, there is mounting evidence that consumers differ in the extent to which they prefer certain nutritional quality attributes of bread. Cooper et al. (2007) handbook titled "Organic food safety and quality" defines nutritional quality as the inherent biological or health value of products including the ratio of beneficial to harmful substances, taste, fragrance, freshness, and shelf-life, as well as the risk of pathogen contamination as important quality characteristics that govern consumer behavior. Even though many experts may have different definitions due to varied connotations, there is a consensus that nutritional quality attributes signify a value addition to a consumer's physical health, growth, development, reproduction, and general well-being.

This study aims to determine students' preferences for nutritional quality attributes in different types of bread. In this research, we are interested in consumers' preference for nutritional quality attributes of bread and what factors influence their decision by employing a choice experiment. The choice experiment examines native and international students' preference and WTP for whole grain or refined grain bread through a stated preference method. To accomplish this, we set up a choice experiment with representative sample data of 189 students of Göttingen university. Our main research question is "What is the effect of health information on students' willingness to pay for Whole grain bread?"

Thus, our study contributes to the existing literature as follows. First, we aim to provide empirical evidence on students' preference for nutritional quality attributes of bread. The

existing empirical evidence on young German consumers' preference and WTP for different value-added attributes in whole grain bread only gives evidence of the functional attributes of bread (Meyerding et al., 2018). Secondly, we aim to contribute towards expanding the knowledge on consumer heterogeneity concerning nutritional quality attributes by employing the case of bread. Thirdly, the element of originality is the study's focus on students in Goettingen, thus moving away from the norm and revealing preferences in a small multicultural environment**.**

The article will be structured as follows: the next section describes the literature review, then followed by the materials and methods used within the study in the third section. The results of the choice experiment will be presented in the fourth section. In the fifth section, the results will be critically examined and discussed. Finally, the findings will be summarized in the conclusion and further implications for marketing, product development, and future research fields will be noted.

## 2. Literature Review

There is a rapidly growing literature examining consumer attitudes towards food products that have enhanced functional, nutritional, and health benefits. Comprehensive reviews of this literature are provided by Siro et al. (2008) and Pothoulaki and Chryssochoidis (2009). West et al. (2002) provide a relatively early example of consumers' preference for functional food attributes. They investigated the attitudes, beliefs, knowledge, and willingness to pay (WTP) for products that promote health. They employed a choice experiment with a sample of Canadian households to derive the price/functional property trade-off made by consumers. Employing a random parameters logit (RPL) model they found that Canadian consumers highly rated and approved of the functional properties of the food products. They were WTP for a functional food property under the condition that, apart from the safety and nutritional dimension of food, this would deliver disease prevention properties.

Using a choice experiment and MEC/laddering analysis, Bitzios et al. (2011) investigated how introducing functional qualities will alter consumer attitudes toward bread. They discover that respondents consider the kind of flour used to make bread, as well as the cost, texture, flavor, scent, and perceived healthiness. Consumers are also shown to be willing to pay for products that contain functional ingredients as well as bread that may offer simple health benefits. Meyerding et al. (2018) investigate consumer preferences for superfood ingredients in different types of bread and find that consumers value bread that serves a functional purpose through superfood ingredients such as linseed or chia.

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Tueber et al. (2016) conducted a research analysis based on a combination of hedonic evaluations with experimental auctions under three different information scenarios employing cluster analysis. The random effects Tobit models find significant heterogeneity across consumer clusters concerning the responsiveness to extrinsic information. Even though consumers have a high preference for functional foods, they are not willing to sacrifice taste. Gellynck et al. (2009) investigated consumers' perception of quality bread towards sensory health and nutritious attributes because of the declining consumption over the years. They identified four consumer segments and find that in all the different segments, consumers perceive bread to be tasteless, non-nutritious, and unhealthy.

Other related studies in other areas have been conducted using a variety of stated and revealed preference approaches, such as the choice experiment (CE) method, contingent valuation method, and hedonic pricing method (Goldberg and Roosen, 2007; Annett et al., 2008). The results of this research generally show that consumers in developed nations were willing to pay more for nutritional quality foods.

According to a survey study by Lambert et al. 2009, northern and eastern Europeans and young people prefer bread with nutritional benefits. French and southern European nations, in contrast, place a greater emphasis on the taste and the freshness of the product. Thus, there is a complicated matrix of qualitative and social views regarding bread that varies in each country. Overall, the existing literature in this area indicates that consumers view bread containing nutritional quality attributes positively. However, these findings need to be qualified in terms of which nutritional quality attributes are most preferred and the impact of health information on the choice of bread they buy. Again, It has been noted in the wider literature on food choices that consumers respond very strongly to positive health messages on food labels and appear to adjust their preferences and willingness to pay. It is, therefore, an interesting question to consider if respondents' willingness to pay for nutritional quality attributes in bread type is affected to a greater or lesser extent by the health information.

**Materials and Methods**

In this section, we describe our sampling strategy within the university context and how we approached the experimental design for the choice sets, descriptive statistics of the survey data, and a previewofn the econometric models utilized to achieve our results.

### 2.1. Sampling and Experimental Design

To approach our research question, the grain types, prices, and availability of nutritional information were modeled as key attributes that can affect consumer choices, while considering time and budget constraints on the possible complexity level of our study. These attributes are selected based on popular options on the kiosk, supermarket and the university canteen. As seen in Table 1, our experiment focuses on the interaction of the three attributes, and we consider key theoretical requirements.

*Table 1*: Attributes and levels for bread types

| Attributes | Description | Levels | Reference level |
|---|---|---|---|
| Bread Grain Type | This refers to the type and form of grain/flour used to make the bread. | Refine Rye grain (rr) | Refined Wheat grain (ww) |
| | | Refined Wheat grain (rw) | |
| | | Whole Wheat grain (ww) | |
| | | Whole Rye grain (wr) | |
| Nutrition Information | This attribute refers to the way nutrition information is presented on the bread. | Nutritional fact (nf) | No nutritional information |
| | | Nutritional Score (ns) | |
| | | Nutritional Fact + Nutritional Score (nfs) | |
| | | No Nutritional information | |
| Price | The cost in (Euro) of buying one 500g loaf of bread. | € 1.99 | |
| | | € 2.99 | |
| | | € 3.99 | |
| | | € 4.99 | |

Level balance ensures that all the attributes had the same number of levels. Item balance ensures keeping the number of alternatives in our choice situation equal and utility balance ensures that the alternatives in our choice sets are not so superficial that the probability of them being selected is reduced.

To model the experiment, we utilized the Coordinate Exchange Algorithm (CEA) in R to identify choice situations with the most minimal D-errors and maintain optimal statistical efficiency. Including opt-out options, our generated choice sets of 16 were also split into two

blocks of 8 each, to capture more variability within our respondents. Figure 1 shows a snippet of a choice set in the online survey.

*Figure 1: Example of a choice set in our choice experiment*



Specifically for our research question, we implemented a random allocation of receiving health information, as the treatment. The treatment focused on enlightening the respondents on the difference between Wheat, Rye grains, and the whole grain or refined grain kind of bread. Considering that the wheat grain type is the standard nutritious type of bread consumed by Germans (Tueber et al., 2016), our treatment focused heavily on highlighting the positive impacts of consuming Rye-grain over wheat-grain-based bread and whole grain bread type over refined grain bread type. Hence, we would expect higher chances of choice selection for the wheat-grain over Rye-grain bread.

### 2.2. Data

With a focus on students at the University of Göttingen, our survey was deployed between the 20th of June and to 1st of July, using the KoboToolbox CAPI software. We utilized student networks and the university's global communication channel with a €15 voucher raffle draw offer and recorded 189 respondents. After the data cleaning process, we had a total of 187 respondents (duplication) and a total of 1496 choice observations (187 x 8). Our survey also included a series of Likert scale questions where the respondents were asked to rank the attribute in our choice set by the level of importance and preference. This would prove useful for quality contextual information to support the findings of our result.

Table 2 below, shows a summary of the sample statistics collected. Decomposed into total, treated and non-treated groups, we find a similar distribution across both groups e.g., the average age in our sample is 26.1 years, 25.5 years in the treated group, and 26.4 years in the non-treated group. On average, respondents are equally distributed between the groups and

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*Table 2*: *Sample statistics*

| Variable Name | Description | Total Population | | Treated | | Non-Treated | |
|---|---|---|---|---|---|---|---|
| | | Mean | Std. Dev | Mean | Std. Dev | Mean | Std. Dev |
| age | 17 < age < 36 | 26.1 | 4.41 | 25.5 | 3.65 | 26.4 | 4.81 |
| bread_consumption | 7 = daily; 6 = Several times a week | 6.26 | 0.891 | 6.2 | 0.876 | 6.29 | 0.903 |
| Gender | 0 = Female; 1 = Male | 0.353 | 0.479 | 0.338 | 0.473 | 0.363 | 0.483 |
| germany_born | 0 = International student; 1 = German student | 0.476 | 0.501 | 0.486 | 0.5 | 0.469 | 0.501 |
| income | €0 < Income < €3501 | 947 | 646 | 900 | 470 | 977 | 737 |
| marital_status | 1 = Single; 2 = Married; 3 = Married with children | 1.41 | 0.89 | 1.3 | 0.767 | 1.49 | 0.955 |
| nutrition_disease | 0 = No nutrition related disease | 0.0588 | 0.236 | 0.108 | 0.311 | 0.0265 | 0.161 |
| time_germany | No. of years spent in Germany | 2.68 | 0.832 | 2.74 | 0.939 | 2.65 | 0.755 |
| where_purchase | 1 = Bakery; 2 = Supermarket; 3 = I bake myself | 1.91 | 0.584 | 1.91 | 0.574 | 1.91 | 0.591 |

our statistical tests show that there is no significant difference between the treated and non-treated groups.

### 2.3. Econometric Model

The econometric analysis for this paper seeks to understand the choice patterns for our experiment and this is based on the random utility theory. Our model recognizes that direct utilities cannot be measured, thus we assume that the respondents derive utilities based on the attributes of the bread and assigns utility weights accordingly. So the idea is to measure the probability of making a choice based on specific observed and unobserved attributes of the bread type.

We model our experiment, assuming that the respondents' utility is latent with only the choice Y of alternative s (s=0, 1, 2) for respondent ɳ (ɳ= 1, …,187) in choice situation j(j=1,…,8). This can be depicted as:

$$U_{ɳsj} = V_{ɳsj} + \varepsilon_{ɳsj} \qquad (1)$$

Where $\qquad V_{ɳsj} = \sum_{k=1}^{k} \beta_k x_{ɳsjk} \qquad (2)$

$V_{ɳsj}$ captures the vector of observed explanatory variables including the specified attributes of our bread types (e.g., grain, price levels etc.), that inform the choices of the respondents and $\varepsilon_{ɳsj}$ shows the unobserved attributes and characteristics in the choice situation. This is assumed to be *iid*[1] while the $\beta$ coefficients are the utility weights, assigned by the respondents.

Thus, our estimation utilises the mixed logit model, relaxing the independence of irrelevant (IIA) assumption and considering random parameters amongst the respondents, to estimate the utility weights assigned. Our model acknowledges preference heterogeneities amongst the observed attributes and describes the respondents' utility weights to be:

$$\beta_{nk} = \beta_k + \Delta z_n + \Gamma v_n \qquad (3)$$

Where $\beta$ is the vector of mean attribute utility weights in the population, which is heterogenous in our sample, $z_n$ shows the observed heterogenous characteristics of our respondents which also affects their preferences. $\Gamma$ is a diagonal matrix which contains $\sigma$ (the standard deviation of the distribution of the individual taste parameters ($\beta i$)) round the population mean taste parameter ($\beta$)) on its diagonal and $v$ is the individual and choice specific unobserved random disturbances with mean 0 and standard deviation 1 (Kassie et al. 2017). However, we do not exploit scale heterogeneities in our model and thus, the scale of our error term is set to constant of 1.

The MIXL model also helps estimate the willingness-to-pay, as required to answer our research question. This is depicted as:

$$WTP_n = -\frac{\beta_n^a}{\beta_n^p} \qquad (4)$$

Where $\beta_n^a$ is the utility weight for the attribute and $\beta_n^p$ is the price coefficient (Hess and Train 2017).

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[1] independently and identically distributed

## 3.  Results and Discussion

In this section we discuss the results of our MIXL model, including the preferences and WTP for the bread and their attributes. To answer our research question, we subset our data into the treated and non-treated groups to see potential differences in assigned utility weights between the groups. This will help give an indication as to, the effect of the provision of health information on the preferences for whole and refined grain types.

### 3.1. Results

In Table 3, we estimate the average MIXL model preference and WTP for our taste parameters. Our model finds a strong preference for whole wheat over refined wheat in both the treated and untreated group. The non-treated group has a higher preference for whole grain bread (wheat & rye) but when treated, the preference for whole wheat is reduced but significant while whole rye becomes insignificant. The treatment is associated with a reduction of utility weight for whole wheat (probability of choice from 1.24 to 1.11) and whole rye (probability of choice from 0.84 to an insignificant 0.45). We also find that the preference for refined rye over refined wheat is insignificant regardless of the treatment.

*Table 3*: MIXL Model

| Attributes | Estimate | | Willingness-to-Pay | |
| --- | --- | --- | --- | --- |
| | **Treated** | **Non-treated** | **Treated** | **Non-treated** |
| asc_a | 2.50*** | 3.11*** | -2.96*** | -3.31*** |
| asc_b | 2.76*** | 3.25*** | -3.27*** | -3.46*** |
| wr | 0.45 | 0.84** | -0.53 | -0.90** |
| ww | 1.11*** | 1.24*** | -1.32*** | -1.32*** |
| rr | 0.26 | 0.18 | -0.30 | -0.19 |
| nf | 0.62* | 0.28 | -0.73* | -0.30 |
| ns | 0.62** | 0.15 | -0.73* | -0.16 |
| nsf | 0.41$^+$ | 0.16 | -0.48$^+$ | -0.17 |
| pr | -0.84*** | -0.94*** | - | - |
| sd.wr | 1.98*** | 2.40*** | -2.35*** | -2.56*** |
| sd.ww | 1.70*** | 1.55*** | -2.02*** | -1.66*** |
| sd.rr | 1.04** | 1.45*** | -1.23** | -1.54*** |
| sd.nf | 0.08 | 0.05 | -0.10 | -0.06 |
| sd.ns | 0.01 | 0.04 | -0.02 | -0.04 |
| sd.nsf | 0.003 | 0.02 | -0.004 | -0.03 |
| sd.pr | 0.49*** | 0.63*** | -0.58*** | -0.67*** |

+ $p<0.1$; * $p<0.05$; ** $p<0.01$; *** $p<0.001$

However, the treated group has a strong preference for nutritional facts, nutritional score, and a combination of both which is significant at 5%, 1% and 10% respectively. The price attribute for both group is highly significant and has a negative relationship with the probability of choice for bread. This strengthens the internal validity of our experiment, by confirming a negatively sloped demand curve for bread amongst students in Göttingen. Although Table 3 shows that the treatment reduces the preference for whole grain, we find that there are unobserved heterogeneities around the mean of the parameters for whole rye, whole wheat, refined rye, price for both treated and the untreated group.

Thus, we introduced observed variables to explain the unobserved heterogeneities. We made an iteration using the AIC score of the model, to select optimal combination of variables for explaining the heterogeneities in the choice probabilities[2]. In Appendix 1, we selected being an international student, gender, and income of the respondents because that combination gave the lowest AIC scores. Table 4 below depicts the estimation of the student preferences and willingness to pay, with reference attribute – whole wheat grain bread.

In the non-treated group, the preference for whole wheat & whole rye respectively, is significantly higher than the preference for refined wheat but the treated group shows an increase in the preference for whole rye while the preference for whole wheat reduces and becomes insignificant. Also, the results show that the treatment is associated with a higher preference for refined rye. The results signify that on average, the treatment is strongly associated with impacting preference for rye grain bread over wheat grain bread, as opposed to the preference of whole grain over refined grain-based bread types. As opposed to Table 3, controlling with the key variables has revealed the initial unobserved heterogeneities, especially regarding the preference for refined rye over refined wheat.

Table 4 also shows the interaction between being an international student with bread choice. We find that international students have a negative likelihood of choosing any kind of bread type over the refined wheat bread type and this signals the refined wheat bread to be a sort of status quo for this subgroup. However, the provision of the treatment reduced the magnitude of discounting for the whole wheat, whole rye and refined rye grain bread. This proves that the influence of the provision of health information is limited on the choice preferences for

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[2] Akaike Information Criterion (AIC) which can be used to determine the best out of multiple models.

**Table 4:** MIXL model preference estimation with unobserved heterogeneities

| Attributes | Estimate | | Willingness-to -Pay | |
|---|---|---|---|---|
| | Treated | Non-treated | Treated | Non-treated |
| asc_a | 2.55*** | 3.08*** | -3.53*** | -2.47*** |
| asc_b | 2.84*** | 3.26*** | -3.94*** | -2.61*** |
| wr | 2.05** | 1.53** | -2.85* | -1.23** |
| ww | 1.1 | 1.72*** | -1.53 | -1.38*** |
| rr | 1.87** | 1.07* | -2.59** | -0.86* |
| nf | -0.61 | -0.37 | 0.85 | 0.3 |
| ns | -0.61 | 0.01 | 0.84 | -0.01 |
| nsf | -0.82 | 0.3 | 1.14 | -0.24 |
| pr | -0.72*** | -1.25*** | - | - |
| wr.int_student | -2.68*** | -3.35*** | 3.72** | 2.69*** |
| wr.Gender | -1.16+ | -0.04 | 1.61 | 0.03 |
| wr.income | 0.0003 | 0.001** | -0.0003 | -0.001** |
| ww.int_student | -1.07+ | -1.76*** | 1.49 | 1.41*** |
| ww.Gender | -0.51 | -0.65 | 0.7 | 0.52 |
| ww.income | 0.001 | 0.001* | -0.001 | -0.001* |
| rr.int_student | -1.6** | -2.75*** | 2.22* | 2.21*** |
| rr.Gender | -1.26* | 0.19 | 1.75* | -0.15 |
| rr.income | -0.0002 | 0.001* | 0.0003 | -0.001* |
| nf.int_student | -0.11 | 0.57 | 0.15 | -0.46 |
| nf.Gender | 0.06 | -0.25 | -0.09 | 0.2 |
| nf.income | 0.001* | 0.0003 | -0.002+ | -0.0002 |
| ns.int_student | 0.33 | 0.32 | -0.46 | -0.26 |
| ns.Gender | -0.23 | -0.37 | 0.32 | 0.3 |
| ns.income | 0.001* | 0.0001 | -0.002+ | -0.0001 |
| nsf.int_student | 0.38 | -0.01 | -0.53 | 0.01 |
| nsf.Gender | -0.29 | -0.03 | 0.41 | 0.02 |
| nsf.income | 0.001* | -0.0001 | -0.002+ | 0.0001 |
| pr.int_student | 0.24 | 0.58*** | -0.33 | -0.46*** |
| pr.Gender | 0.46** | 0.1 | -0.63* | -0.08 |
| pr.income | -0.0010** | -0.0001 | 0.001+ | 0.0001 |
| sd.wr | 1.57*** | 1.93*** | -2.18** | -1.54*** |
| sd.ww | 1.71*** | 1.36*** | -2.38** | -1.09*** |
| sd.rr | 0.85* | 1.04** | -1.18* | -0.83** |
| sd.nf | 0.09 | 0.01 | -0.13 | -0.01 |
| sd.ns | 0.03 | 0.003 | -0.04 | -0.002 |
| sd.nsf | 0.01 | 0.003 | -0.02 | -0.002 |
| sd.pr | 0.47*** | 0.61*** | -0.65*** | -0.49*** |

+ P<0.1; * P<0.05; ** P<0.01; *** P<0.001

international students. The treatment increases the preference for other bread types (both whole and refined) but doesn't make them a better choice over the standard refined wheat grain bread.

Also, we find that the male gender in the treated group has a stronger preference for higher priced bread and reduces their preference for refined rye grain bread over the standard refined wheat grain bread. We could argue this to the notion of perceiving price as a measure of quality and thus, a costlier bread is healthier for keeping fit. However, we find that nutritional information becomes insignificant in the probability of choice for bread, although there is a higher preference for it on average for the treated respondents with a higher income level.

Observing the willingness to pay on average, the treatment is associated with higher WTA for the whole rye and refined rye grain bread. The respondents in the treated group, has a higher premium and are willing to pay €2.85 and €2.59 for whole rye grain and refined rye grain, compared to the non-treated group premium of €1.23 and €0.86 respectively. However, international students have a discounting preference and are willing to accept whole rye grain bread and refined rye grain bread by €3.72 and €2.22 in the treated group; €2.69 and €2.21 in the non-treated group respectively. We also find that the treatment is associated with a reduction and insignificant effect on the willingness to pay a higher price for international students.

The results from the bread attribute Likert scale responses also helps corroborate these findings. Stratified by international and German students, the result is Appendix 2 shows that the German students attribute higher importance to the choice of whole grain for their bread choice, ranked at 5th out of 11 attributes. Compared to the international student's group, who ranks the importance of whole grain as 8th out of 11. Also, international students attribute higher importance to the familiarity of bread type, ranked at 5th, while the German students rank familiarity as 7th out of 11. We argue this to be a strong reason why, despite the provision of information, international students still maintain a strong dislike for whole grain bread over refined grain bread, however reduced.

## 4.   Conclusions

This study seeks to elicit the effect of health information on preference and willingness to pay for whole grain bread amongst students. Our study focused on enrolled students of the university of Göttingen and we approach our CE design by using the coordinate exchange algorithm in R to generate choice sets based on 3 attributes (grain type, nutritional information and price), which were deployed through an online survey. Choice preferences were estimated

using a MIXL model to estimate utility weights assigned by each respondent and WTP estimates were made directly from our model.

The study finds that on average, the treatment (health information) is associated with a higher preference for whole rye grain bread and a lower preference for whole wheat grain bread. The treated group also shows a higher preference for refined rye bread and hence, we argue that the treatment has a stronger impact on preference for rye grain bread than wheat grain bread although it only increases preference for the whole rye kind of bread. Both are mutually exclusive. The interaction with being an international student also reveals that international students have a very strong preference for refined wheat. Although the treatment increases the preference for the whole grain brain type (rye and wheat) and even refined rye bread, the preference and WTP coefficients for the bread types remain negative. This finding is supported by the Likert scale question that reveals international students rank familiarity as being higher on a scale of importance for bread choice, compared to the German students. Also, we find nutritional information to be insignificant in choice preferences of bread except for the treated respondents with higher income, while the treated males showed a stronger preference for only rye grain. Thus, we conclude that the provision of health information increases preference for the whole rye grain on average and improves for all types of grain bread in the international student's subgroup.

Regarding limitations, our study did not explore scale heterogeneities due to the scope of our MIXL model and it is also not eluded from a potential hypothetical bias. Also, the sample size is small and therefore the external validity of the product choice calls for further investigation. The study has some marketing and health policies implication. The university and food firms may fall on the preferences of the students to fashion targeted marketing strategies to meet the demand of both international and native students. Again, university orientation programs can include nutritional quality and available options to sensitize students for improved decision-making.

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## 13. Declaration

We assure you that we have written this work as a group and each member of the group made contributions satisfactory to other members of the group. We state that we have not used any sources and aids other than those indicated that all statements taken from other writings directly or indirectly have been identified and that the work has not yet been submitted in the same or a similar form to any other examining authority. We agree that the present work may be verified with anti-plagiarism software.

Göttingen, 30.07.2022

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**Appendix**

Model iteration using AIC score

| Combination | Model Name | AIC Score |
|---|---|---|
| A | Treated group without heterogenous effects | 1057.099 |
| | Non-treated group without heterogenous effects | 1545.778 |
| B | Treated group with heterogenous effects (int_student X Gender X income) | 1034.662 |
| | Non-treated group with heterogenous effects (int_student X Gender X income) | 1495.133 |
| C | Treated group with heterogenous effects (int_student X Gender X income X where_purchase X marital_status X age) | 1048.041 |
| | Non-treated group with heterogenous effects (int_student X Gender X income X where_purchase X marital_status X age) | 1500 |

*Appendix 1: Model iteration using AIC score*

Likert Scale preferences for German students
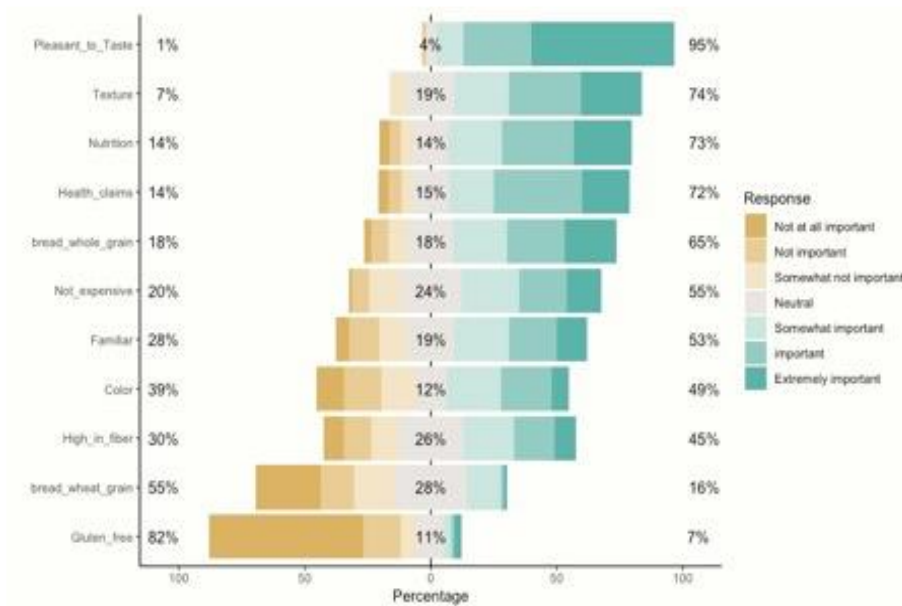


*Appendix 2: Likert scale preference for German students*

# Likert Scale preferences for International students
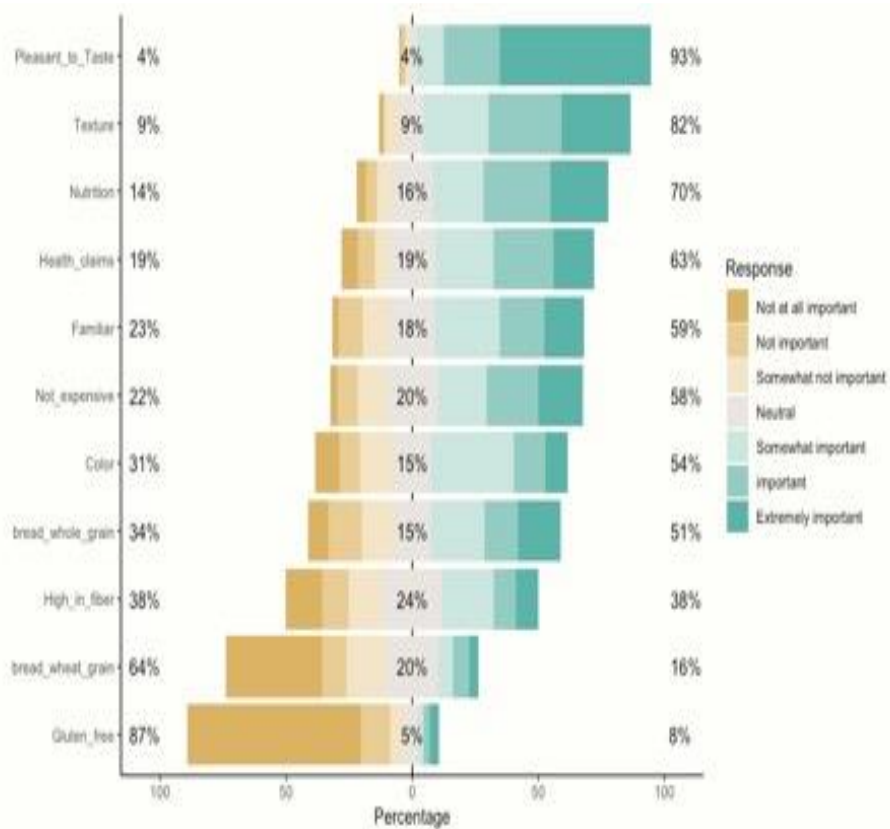


*Appendix 3: Likert scale preference for international students*