

Which “free from”-claims are important to which consumers when buying food?

A consumer segmentation

Sina Nitzko, Laura H. Gertheiss

Abstract

“Free from”-claims on foods are steadily gaining in importance; a uniform legal framework for their use is lacking so far. In the present contribution, “free from”-claims 1.) on the absence of additives/flavorings and 2.) on the absence of gluten/lactose/fructose are examined in more detail. By means of an online questionnaire, 703 German consumers were asked about the relevance of various “free from”-claims when purchasing food, their trust in food manufacturers, as well as their health and naturalness orientation. Bi- and multivariate statistical analysis methods were used to evaluate the data. The analyses identified four consumer segments that differ in terms of the importance of additive/flavoring-related as well as gluten-, lactose-, and fructose-related “free from”-claims when purchasing food: 1.) “free from”-claims disinterested consumers, 2.) “free from” additives/flavorings consumers as well as 3.) moderate or 4.) intensive “free from” consumers. The segments were further characterized in terms of their health and naturalness orientation, their trust in food manufacturers as well as sociodemographic and health-related variables. Additive-/flavoring-related “free from”-claims are slightly to significantly more important than average for 74.6%.

Due to the lack of legal regulations, consumer information on additive-related “free from”-claims should include information on the fact that substances with the same effect can be used despite the claims. There is also a need for research on possible consumer overload due to the variety of “free from”-claims.

Keywords: consumer behavior, food, “free from”-claims, food labeling, market research, gluten, lactose, fructose, food intolerance

Citation

Nitzko S, Gertheiss LH: Which “free from”-claims are important to which consumers when buying food? A consumer segmentation. *Ernahrungs Umschau* 2023; 70(2): 20–34.

Open access: This article is available online:
DOI: 10.4455/eu.2023.004

Peer Reviewed

Manuscript (Original) received: 5 August 2022
Revision accepted: 27 September 2022

Corresponding Author

Dr. Sina Nitzko
University of Göttingen
Department of Agricultural Economics and Rural Development
Platz der Göttinger Sieben 5, 37073 Göttingen/Germany
snitzko@uni-goettingen.de

Introduction

Health and naturalness aspects are important motives for various consumer groups when consuming food [1]. In the course of this, consumers are interested in information about the components of food or strive to avoid various ingredients. These needs have been addressed by the food industry. Products are offered that do not contain ingredients or substances that consumers want to avoid. The absence of these substances is advertised on the packaging. Frequently used are “free from” claims, which are assigned to the “clean labels” [2]. In general, “clean labeling” means the labeling of foods to the effect that certain ingredients/



substances are not contained [3, 4]. Based on textual or visual claims on the packaging (e.g., logos, “free from”-claims), consumers can infer the “purity” of a “clean label” product [2].

The present study considers the consumer relevance of two categories of “free from” claims, i. e., textual claims on food packaging 1.) on the absence of gluten, lactose, and fructose (for products in which these are otherwise naturally present) and 2.) on the absence of additives/ flavorings (in the style of [5]).

“free from”: Fundamentals of Labeling Law

In the food market, “free from” claims are becoming increasingly important. For example, 31% of new foods and beverages introduced in 2015 had “free from”-claims, compared to 20% in 2011 [6].

Nevertheless, there is no legal framework for their use. The claim of absence of additives refers to the substances permitted in Regulation (EC) No 1333/2008 [7]. However, instead of the avoided additives, the product may contain ingredients with similar effects that are not considered additives, e. g., in products labeled “free of preservatives”, a preservative effect may be achieved by substances such as citric acid [8]. There is the risk that the consumer expectations associated with the claims will not be met, resulting in misinterpretations [9] and adverse changes in consumer behavior [5]. The terms used for flavoring-related “free from” claims refer to Regulation (EC) No 1334/2008 [10]. It is difficult for consumers to differentiate between the flavoring types. Thus, the expectations associated with the claims may differ from the real product properties [11].

Gluten labeling is regulated by Commission Regulation (EC) No 41/2009 [12]. There are no requirements for lactose labeling in the EU (exceptions: requirements for milk in the EU as well as for cheese and dairy products in Germany). There are also no laws for the claim “fructose-free”.

Consumer Relevance

“free from”-Claims on Additives or Flavorings

Regarding food additives, the present study considers “free from” claims in relation to the four additive classes of flavor enhancers, colorants, preservatives, and sweeteners. These are viewed very critically by consumers [13, 14]. In connection with consumers’ naturalness and health orientation as well as their trust in food manufacturers, it is shown that a high preference for naturalness is accompanied by a low acceptance of additives [15]. The findings of Szűcs et al. [16, 17] suggest that consumers who perceive additives as risky to their health are more careful to avoid additives when purchasing food. In addition, there is evidence of limited trust in producers of additive-rich products [18].

Flavorings are not considered additives in the legal sense. Studies on the relationships between trust in manufacturers, the health or naturalness orientation of the consumers, and the relevance of flavoring-related “free from”-claims are still lacking.

“free from”-Claims on Gluten, Lactose, Fructose

The protein gluten is found in various types of cereals. An inflammatory, autoimmune disease of the small intestine triggered by intolerance to gluten is celiac disease [19]. The prevalence of celiac disease in Europe is 1%, with country-specific differences. Germany

shows a prevalence of 0.37% [20]. Gluten is present in all foods made from gluten-containing cereals or containing the processed products of these cereals [21, 22]. In addition, gluten may be “hidden” in processed foods (e. g., meat products) [23, 24]. Celiac disease is treated with a gluten-free diet [19].

The proportion of gluten-avoiding consumers exceeds the proportion of persons with celiac disease. Thus, gluten is avoided, among other things, to deal with undesirable symptoms (e. g., flatulence, stomach complaints [25]) or because of expected health benefits. Regarding associations between the relevance of “gluten-free”-claims and naturalness and health orientation as well as trust in manufacturers, it appears that gluten avoidance is essential for health for individuals with celiac disease [26]. Gluten-avoiding individuals without celiac disease show healthier eating behaviors compared to gluten consumers [27]. In addition, naturalness-oriented consumers perceive gluten-free products as healthier. Higher trust in actors in the food sector is associated with a higher willingness to pay for gluten-free products [5]. The disaccharide lactose, which is found in mammalian milk, is absorbed via milk, dairy products, and processed foods. In the small intestine, lactose is broken down by the enzyme lactase. Decreased lactase synthesis/activity results in lactose intolerance. Regarding the prevalence of lactose intolerance, there is a north-south gradient in Europe (e. g., Denmark: 4%, Italy: 72%). In Germany, the prevalence is 16% [28, 29]. The therapy of lactose intolerance consists of a lactose-free diet [28].

Regarding correlations between the relevance of “lactose-free” claims and consumers’ naturalness and health orientation as well as trust in manufacturers, it has been proven that lactose-free products are perceived as healthier, especially when naturalness preference is high. In addition, trust in actors in the food sector is a predictor of the intention to pay more for lactose-free products [5].

The monosaccharide fructose occurs naturally in fruit, honey, and some vegetables. In addition, fructose can be ingested via sweets, beverages, and industrially produced foods [30–32]. Hereditary fructose intolerance is a metabolic disorder whose therapy is fructose avoidance [30]. The prevalence in Central Europe is estimated to be 1:26,100 [33]. Consumer studies on “fructose-free” claims are not yet available.



Aim of the Study

Despite the growing importance of “free from” claims [6, 34], few consumer studies are available. Previous studies have focused on selected “free from”-claims (e. g., [35, 5, 36]). Categories of “free from”-claims are not considered. In addition, there is a lack of studies that use the principle of consumer segmentation and consider the categories of “free from”-claims in combination. Furthermore, the relevance of “free from”-claims in connection with health and naturalness orientation as well as trust in food manufacturers has been little investigated.

The aim of this study is to identify consumer segments on the relevance of two categories of “free from”-claims: 1.) claims on the absence of additives/flavorings and 2.) claims on the absence of gluten/lactose/fructose. In this regard, it should be noted that the explanations on additives in the present study refer to the substances permitted in Regulation (EC) No 1333/2008 [7] and the explanations on flavorings refer to the specifications in Regulation (EC) No 1334/2008 [10]. As shown (III) section “Consumer Relevance”), gluten, lactose, and fructose are naturally present as ingredients in various foods. Furthermore, it is possible to add gluten, lactose, or fructose to processed foods during the manufacturing process (e. g., [37–39]). The explanations on gluten-, lactose-, and fructose-related “free from”-claims in this article refer exclusively to foods that otherwise naturally contain these ingredients. Processed foods labeled “free from” gluten, lactose, or fructose that do not naturally contain gluten, lactose, or fructose and in whose manufacturing process the addition of the substances has been omitted are not considered in the present study. The consumer segments identified in relation to the two categories of “free from”-claims are characterized in terms of consumer health and naturalness orientation as well as consumer trust in manufacturers. Against the background of the lack of legal requirements, implications for (target group-specific) consumer information on “free from”-claims can be derived based on the findings.

Material and Methods

Data Collection and Questionnaire

The data collection was conducted via an external online panel provider using an online questionnaire (♦ page 33) in November 2018. On a 5-point scale (1 = not important, 2 = less important, 3 = moder-

ately important, 4 = quite important, 5 = very important), participants were asked to indicate how important various “free from”-claims (♦ Table 1) were to them when buying food. Participants were also asked about their health and naturalness orientation and trust in food manufacturers (♦ Table 2). The items were rated on a 5-point scale (1 = strongly disagree, 2 = rather disagree, 3 = partly agree, 4 = rather agree, 5 = strongly agree). In addition to sociodemographic variables, respondents were asked whether they had any food intolerances.

Sample

The sample includes 703 German consumers. A quota sample was collected. In ♦ Table 3, the frequencies achieved in the sample and the population shares according to federal statistics are shown for the quotation variables.

Statistical Analysis

The analysis was carried out with the program SPSS 26. Both the statements on the importance of the “free from”-claims for consumers when buying food as well as the statements on health and naturalness orientation and on trust in food manufacturers were each subjected to a factor analysis. In the next step, a cluster analysis was performed. The identified factors “absence of additives/flavorings” and “absence of gluten/lactose/fructose” were included as cluster-forming variables. Sociodemographic as well as health-related variables were included as cluster-describing variables, in addition to the formed factors “trust in food manufacturers”, “naturalness orientation”, and “health orientation”. After identification and elimination of outliers, the optimal cluster number was determined using the Ward method. The final solution was determined using the k-means method. Differences between clusters were tested using ANOVAs as well as cross-tabulations and χ^2 -tests.

Results

Factor Analysis: Statements on the Importance of “free from”-Claims in Food Purchasing

Two factors were identified in the factor analysis with the statements on the importance of “free from”-claims (Kaiser-Meyer-Olkin [KMO] criterion = 0.88¹; total variance explained: 72.5%). The first factor includes claims on the absence of additives and flavor-

Factor (Cronbach's α)	Item	M	SD	Factor loading
Absence of additives and flavorings (0.89)	without flavor enhancers	3.65	1.22	0.88
	without colorants	3.36	1.22	0.85
	without preservatives	3.53	1.21	0.84
	without flavorings	2.99	1.19	0.78
	without sweeteners	3.40	1.28	0.71
Absence of gluten, lactose, and fructose (0.83)	free from gluten	2.13	1.24	0.88
	free from lactose	2.08	1.29	0.87
	free from fructose	2.35	1.30	0.75

Tab. 1: Result of the factor analysis with the items on the importance of “free from”-claims for consumers when buying food
M: mean; SD: standard deviation



ings. Consumers consider flavorings to be additives [14], although they do not count as such in the legal sense. The second factor comprises statements with reference to the absence of gluten, lactose, and fructose (♦ Table 1).

Factor Analysis: Statements on Trust in Food Manufacturers, Health and Naturalness Orientation

Three factors (♦ Table 2) were identified in the factor analysis with the statements on trust in food manufacturers, naturalness orientation, and health orientation (KMO = 0.86; total variance explained: 70.1%).

Cluster Analysis

Four clusters were identified by means of cluster analysis, which are explained in more detail below (♦ Table 4; ♦ Figure 1).

“Free from”-claims disinterested consumers (cluster C1) rate the absence of additives/flavorings as not very important. The absence of gluten, lactose, and fructose is also not considered important. Naturalness orientation is average among these individuals. Health orientation and trust in manufacturers are below average (♦ Table 4).

Among the “free from” additives/flavorings consumers (cluster C2), the absence of additives/flavorings is considered quite important. In contrast, the absence of gluten, lactose, and

Characteristic	Frequencies in the sample (%)	Population proportions (%)
Gender ^a		
Male	48.6	49.3
Female	51.4	50.7
Age group (in years) ^b		
18–29	17.1	17.0
30–39	14.2	16.8
40–49	16.4	17.0
50–59	24.3	22.9
60–69	19.5	18.2
70–75	8.5	8.1
Education ^c		
still in school	1.3	1.0
certificate of secondary education	30.9	29.5
general certificate of secondary education	32.4	32.6
advanced technical college entrance qualification/university entrance diploma	33.1	33.2
without school leaving certificate	2.3	3.7

Tab. 3: Sociodemographics of the sample in terms of age, gender, and education compared with the population proportions in Germany according to federal statistics^a[40], ^b[41], ^c[42]

fructose is of little to no importance to them. These persons show an above-average naturalness and an average health orientation, while their trust in manufacturers is below average.

Among the moderate “free from” consumers (cluster C3), the relevance of the absence of additives/flavorings is slightly above average, while the importance of the absence of gluten, lactose, and

¹ The Kaiser-Meyer-Olkin (KMO) criterion is used to assess the suitability of the data for performing a factor analysis. The KMO criterion can take values between 0 and 1. The lowest acceptable limit is 0.50 [43].

Factor (Cronbach's α)	Item	M	SD	Factor loading
Naturalness orientation (0.88)	I prefer natural foods.	3.71	1.04	0.86
	I prefer natural products. i.e.. products without additives. ^a	3.70	1.05	0.84
	To me the naturalness of the food that I buy is an important quality. ^b	3.74	1.00	0.77
	I prefer less processed foods.	3.67	0.95	0.78
Health consciousness (0.84)	I consider myself very health conscious. ^c	3.19	1.06	0.81
	I always eat a healthy and balanced diet. ^d	3.14	0.99	0.78
	I rarely eat unhealthy things. ^d	2.88	1.00	0.75
	Other people pay more attention to their health than I do. ^e (–)	3.37	1.10	-0.77
Trust in food manufacturers (0.75)	I have confidence in the producers of food.	2.86	0.92	0.83
	I rely on information that food companies provide about their products.	3.06	0.94	0.82
	Food companies provide consumers with honest information about the manufacture of their products. ^f	2.34	0.93	0.79

Tab. 2: Result of the factor analysis with the items on trust in food producers, naturalness, and health orientation on the part of consumers

^a la the item was taken from Grunert et al. [44], used in a modified form

^b the item was taken from Grunert et al. [44]

^c the item was taken from Chen [45]

^d the item was taken from Diehl [46]

^e the item was taken from Diehl [46], used in a modified form

^f the item was taken from Bergmann [47], used in a modified form

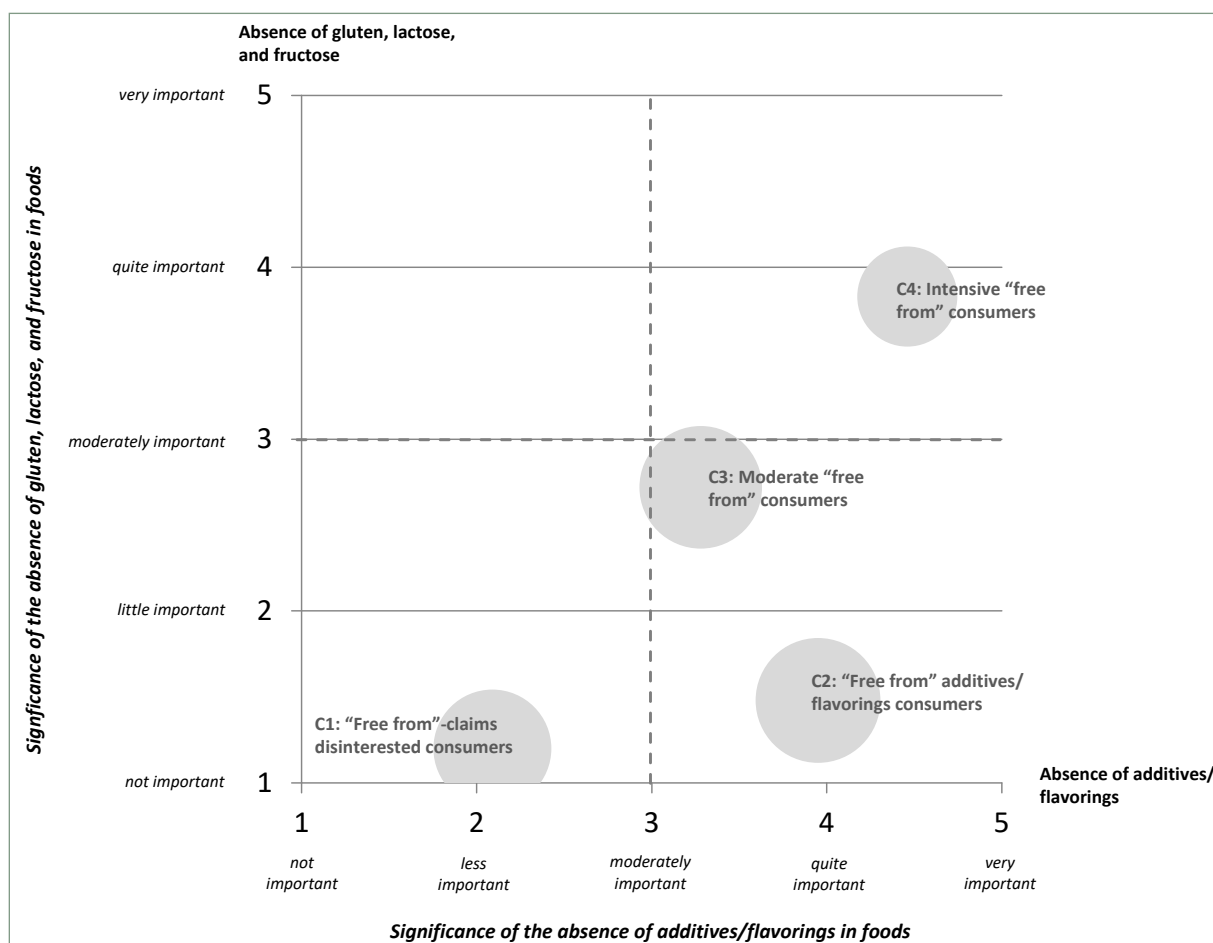


Fig. 1: Graphical representation of the four consumer segments identified in the cluster analysis regarding the significance of the absence of additives/ flavorings as well as the absence of gluten/ lactose/ fructose in food purchases

fructose is slightly below average. The naturalness orientation is above average for these individuals. Their health orientation and trust in manufacturers are slightly below average.

The intensive “free from” consumers (cluster C4) rate the absence of additives/ flavorings as quite to very important, and the absence of gluten, lactose, and fructose as quite important. Naturalness and health orientation are above average among them, while trust in manufacturers is slightly below average.

Discussion

In the present study, four consumer segments were identified regarding the importance of claims on the absence of additives/ flavorings as well as gluten/ lactose/ fructose in food purchasing. While the “free from” additives/ flavorings consumers differentiate between the two categories of “free from”-claims, the other segments show a low (“free from”-claims disinterested consumers), medium (moderate “free from” consumers) or high (intensive “free from” consumers) general relevance of “free from”-claims. Consumer segments were characterized in terms of trust in food manufacturers, consumer health and naturalness orientation, as well as sociodemographic and health-related variables.

Overall, 74.6% of respondents indicated a slightly to significantly above-average relevance of the absence of additives/ flavorings. Accordingly, these “free from”-claims reach a broad consumer group. Available studies also show that many consumers feel the need to avoid additives [48]. However, the increasing use of additive-related “free from”-claims is accompanied by the danger that consumer concerns about additive risks will be confirmed or reinforced [49]. This is despite the fact that only approved additives and flavorings may be used within the EU and that health safety is a prerequisite for approval [7, 10]. As part of the approval process [50], a safety assessment is carried out by the European Food Safety Authority (EFSA) for each substance. Based on this, the EFSA prepares opinions on the safety assessment of additives (e. g., [51, 52]) and flavorings (e. g., [53, 54]). However, it should also be noted that interactions may occur between additives used, which may be associated with desirable or undesirable consequences for food quality and human health [55]. In prac-

Variable	C1: "Free from"-claims disinterested consumers (n = 178; 25%) M (SD)	C2: "Free from" additives/flavorings consumers (n = 202; 28.77%) M (SD)	C3: Moderate "free from" consumers (n = 190; 27%) M (SD)	C4: Intensive "free from" consumers (n = 132; 19%) M (SD)	Results of ANOVA or χ^2 -test	Results of post hoc tests (significant differences)
Cluster-forming variables						
Absence of additives/flavorings ^a	2.09 (0.68)	3.95 (0.55)	3.28 (0.49)	4.46 (0.46)	F = 556.32 p = 0.000	C1<C2, C1<C3 C1<C4, C2>C3 C2<C4, C3<C4
Absence of gluten, lactose, and fructose ^a	1.20 (0.32)	1.48 (0.47)	2.72 (0.49)	3.83 (0.69)	F = 935.39 p = 0.000	C1<C2, C1<C3 C1<C4 C2<C3, C2<C4 C3<C4
Cluster-describing variables						
Naturalness orientation ^b	2.98 (0.86)	4.12 (0.65)	3.55 (0.64)	4.29 (0.63)	F = 119.96 p = 0.000	C1<C2; C1<C3 C1<C4; C2>C3 C3<C4
Health orientation ^b	2.55 (0.83)	3.09 (0.84)	2.90 (0.71)	3.41 (0.81)	F = 31.95 p = 0.000	C1<C2; C1<C3 C1<C4; C2<C4 C3<C4
Trust in food manufacturers ^b	2.86 (0.78)	2.56 (0.76)	2.83 (0.66)	2.80 (0.82)	F = 6.60 p = 0.000	C1>C2; C2<C3 C2<C4
Gender (%)					$\chi^2 = 17.34$ p = 0.001	
male	55.1 %	38.6 %	56.8 %	43.9 %		
female	44.9 %	61.4 %	43.2 %	56.1 %		
Age in years	43.9 (16.9)	47.84 (15.4)	48.72 (16.4)	52.56 (14.2)	F = 7.72 p = 0.000	C1<C3 C1<C4 C2<C4
Self-reported intolerance to gluten/lactose/fructose (%)						
yes	0.6 %	3.0 %	10.0 %	6.1 %	$\chi^2 = 20.01$ p = 0.000	
no	99.4 %	97.0 %	90.0 %	93.9 %		

Tab. 4: Presentation of the four consumer segments identified in the cluster analysis regarding the cluster-forming and cluster-describing variables

^a Scale: 1 = not important, 2 = less important, 3 = moderately important, 4 = quite important, 5 = very important

^b Scale: 1 = strongly disagree, 2 = rather disagree, 3 = partly agree, 4 = rather agree, 5 = strongly agree

The frequencies in **bold** are above or below the expected values.

M: mean; SD: standard deviation

tice, it is not possible within the scope of the authorization process to test additives in all possible combinations and the respective associated interactions.

The absence of gluten, lactose, and fructose is of average to slightly below-average importance for 45.9% of respondents when buying food, mostly for reasons other than intolerance. The percentage of consumers with an intolerance to gluten, lactose, or fructose varies between 0.6% and 10% across the clusters.

45.9% of respondents show an average to above-average general interest in "free from" claims. The use of "free from" claims often focuses on individual product attributes. The overall health value and the degree of processing are not considered. Due to the (health) halo effect, there is a risk that products with "free from" claims are perceived as healthier overall [56]. The health value of products may be overestimated, and consumers may be convinced that they consume "healthy" food. Unintentionally, this may re-

sult in an unhealthier diet or increased consumption [57–59].

"free from"-Claims Disinterested Consumers

For the "free from"-claims disinterested consumers (cluster C1), all "free from"-claims are below average in importance. The naturalness orientation of the cluster is average, while the trust in food manufacturers and health orientation are below average. The proportion of consumers with a gluten, lactose, or fructose intolerance is the lowest in the cluster comparison at 0.6%.

The average naturalness orientation of the cluster suggests that other consumption mo-



tives and associated product attributes are more central. For example, Brunner et al. [60] show that a lower food-related naturalness preference is associated with a higher importance of the convenience aspect. The use of additives/ flavorings is characteristic of convenience products and the associated properties (e. g., shelf life) may be perceived as beneficial [61]. Regarding the assessment of gluten-, fructose-, and lactose-related “free from”-claims as not to less important, it can be assumed that these substances are regarded as natural ingredients [5].

In addition, as mentioned, other consumption motives and product attributes could be more central. Against the background of the below-average health awareness of the cluster, it can be assumed that there are fewer health concerns regarding additives/ flavorings compared to more health-oriented consumers (e. g., intensive “free from” consumers). Accordingly, the absence of additives/ flavorings is of low relevance to consumers in the cluster when purchasing food. Radam et al. [35] also provide evidence that a proportion of 18% of consumers do not perceive food products with “without glutamate” claims as healthier. In a study by Szűcs et al. [17], it is shown that a low perceived health risk in relation to additives is associated with a lower tendency of consumers to take measures to reduce the intake of additives. In connection with the low relevance of the absence of gluten, lactose, and fructose in the group of the “free from”-claims disinterested consumers, available studies also show that gluten/ lactose consumers have a lower health orientation than gluten/ lactose avoiders [62, 63]. The “free from”-claims disinterested consumers report a slightly below average and, in a cluster comparison, the highest level of trust in food manufacturers. This is accompanied by the lowest importance of the absence of additives/ flavorings in food purchasing in a cluster comparison. The findings of Szűcs et al. [16] suggest that consumer trust in the use of additives has a negative effect on taking action to reduce additive intake. Due to higher trust, cluster-specific consumption motives (e. g., price orientation [64]) might dominate in purchasing, which could explain the low relevance of gluten-, lactose-, and fructose-related “free from”-claims (e. g., higher price intensity of gluten-free compared to regular products [62]).

In the cluster comparison, the “free from”-claims disinterested consumers have the lowest average age. Regarding the low relevance of the absence of additives/ flavorings in the cluster, Steptoe et al. [65] also show a lower interest in additive-free foods in younger age groups. In general, there are age-specific differences regarding food-related consumption motives. While price and time aspects are significant in younger age groups, the health aspect gains relevance with increasing age [64]. Against this background, it can be assumed that in the cluster with the lowest average age, the advantages associated with additives/ flavorings (e. g., price advantages) are more significant or the absence of these substances is of less relevance. Gluten-, lactose-, and fructose-related “free from”-claims are also rated as less important by the “free from”-claims disinterested consumers. Age-specific consumption motives could also be used as explanatory background for this finding. For example, gluten- and lactose-free foods are perceived as healthier [5] (with a lower relevance of the health aspect in younger age groups) but are characterized by a higher average price [62] (with a higher price orientation in younger age groups).

“free from” Additives/Flavorings Consumers

The absence of additives/ flavorings is of above-average relevance for the “free from” additives/ flavorings consumers (cluster C2), while the absence of gluten, lactose, and fructose is of below-average importance. In addition to the above-average naturalness orientation, the cluster shows a below-average level of trust in food manufacturers and an average level of health orientation. In connection with the above-average naturalness orientation, Román et al. [66] also show that the absence of substances perceived as negative by consumers, such as additives/ flavorings, and the presence of natural ingredients, such as lactose, are indicators of food-related naturalness.

The average health orientation of the cluster is accompanied by a high relevance of the absence of additives/ flavorings when buying food. Also, a study by Szűcs et al. [17], which refers to consumer samples from southern, eastern as well as southeastern Europe, provides evidence that the perceived health risk of additives has a positive effect on taking action to avoid additives. Similarly, Christensen et al. [14] show that the perceived health risk is among the most frequently cited reasons for additive avoidance.

Gluten, lactose, and fructose absence is of little relevance to this cluster. Overall, available studies show that gluten- and lactose-free food products do not have nutritional benefits compared with regular foods [67, 68]. Rather, a long-term adherence to a gluten-free diet may be associated with nutritional disadvantages (e. g., higher fat and sugar content of gluten-free products [69]).

The cluster is characterized by below-average trust in food manufacturers. Richards et al. [18] also show that anonymous production processes and partly unknown ingredients result in consumer reservations, especially towards additive-enriched products and their manufacturers. Previous studies show that many consumers believe that the use of additives and flavorings is excessive [70, 11] and done to increase profits [71]. As noted, Szűcs et al. [16, 17] provide evidence that reduced consumer confidence in additive use is associated with a higher propensity to take action to reduce additive intake.

The absence of gluten, lactose, and fructose is considered to be of minor importance. The majority (97%) of consumers in this cluster are not intolerant to these ingredients. Against



the background of the lack of a general nutritional added value of gluten- and lactose-free products [67, 68] and the higher prices [62], there is no need for most of the consumers in the cluster to consider these “free from”-claims. In this context, Hartmann et al. [5] provide evidence that consumers with mistrust in actors in the food sector are not convinced that gluten- and lactose-free foods provide additional benefits and are worth a higher price. However, it should be noted that in the study by Hartmann et al. [5], consumer trust in the various food chain actors was surveyed. In the present study, on the other hand, only three items were used to measure trust in food manufacturers.

The proportion of women (or men) in the cluster is above (or below) the expected value. Compared to men, women are characterized by a higher naturalness orientation [66]. Accordingly, natural food ingredients are more significant for women [72]. Accordingly, the absence of gluten, lactose, and fructose in foods that naturally contain these ingredients is given low importance in the cluster. In addition, the absence of what are perceived as unnatural additives is of high relevance in the group of the “free from” additives/ flavorings consumers. Women in other studies also had a low acceptance of additives and associated them with high risks [15].

Moderate “free from” consumers

The response behavior of the moderate “free from” consumers (cluster C3) is characterized by the error of central tendency. The proportion of consumers with gluten, lactose, or fructose intolerance is highest in the group in the cluster comparison and is above the expected value.

The slightly above-average naturalness orientation and the slightly below-average health orientation are accompanied by a slightly above-average relevance of the absence of additives/ flavorings. In addition to the health and naturalness orientation, other consumption motives could also be relevant (e.g., price, convenience orientation [1]), through which (in addition to disadvantages) the advantages of additives are significant (e.g., price advantages, shelf life [61, 48]). The rectified relationship between naturalness orientation and the importance of the absence of additives/ flavorings in the present study may also be due to the items used to assess naturalness orientation. The statements focus on the food composition and partly also specifically on food additives. The ambivalence regarding the relevance of the absence of gluten, lactose, and fructose could result from the uncertainty about the extent to which these are natural ingredients [5] and products with gluten-, lactose-, and fructose-related “free from” claims have health benefits. In this context, an available study on gluten demonstrates that a considerable proportion of consumers does not know what gluten is and cannot name product sources [73]. A study by Chambers et al. [74] on the naturalness evaluation of food ingredients also shows that a proportion of only 23% rate gluten as natural. Wheat flour, on the other hand, is considered natural by 63%, although gluten is contained in wheat. The ambivalence regarding the health benefits of foods with gluten-, lactose-, and fructose-related “free from”-claims may be partly due to the increasing relevance and availability of gluten-, lactose-, and fructose-free products on the food market [5, 6]. Products labeled “free from” gluten, lactose, and fructose, which

otherwise naturally contain these ingredients, are considered healthier by consumers [5]. In addition, media reports about the benefits of a gluten- and lactose-free diet are increasing [75]. On the other hand, scientific evidence for health benefits of avoiding gluten and lactose in the absence of related diseases is lacking. Both gluten-free [67] and lactose-free products [68] show no nutritional benefits compared to regular products.

There is also ambivalence regarding the trust in producers. Consumers recognize the benefits of additives [61] and at the same time distrust foods rich in additives [18]. Regarding the medium relevance of the gluten, lactose, and fructose absence, Hartmann et al. [5] show a positive effect of trust in food chain actors on the willingness to pay for gluten/ lactose-free products.

The cluster comparison shows the highest proportion of consumers with gluten, lactose, or fructose intolerance (10%). In cluster C4, which is characterized by the highest relevance of gluten-, lactose-, and fructose-related “free from”-claims in a cluster comparison, the proportion of consumers with an intolerance is lower at 6.1%. The highest proportion of consumers with an intolerance in the cluster of the moderate “free from” consumers may be partly due to various factors. For consumers with an intolerance, the consumption of products with “free from”-claims may be problematic. According to Commission Regulation (EC) No 41/2009 [12], products labeled “gluten-free” may nevertheless contain up to 20 mg/kg of gluten. This may result in a symptom burden in the presence of celiac disease [76, 77]. There are no uniform limits in the EU for the claims “lactose-free” [78] and “fructose-free” [79]. Against this background, consumers with intolerances could use other options (besides products with “free from”-claims) to avoid the consumption of the substance in question. For example, they can consume foods that do not naturally contain the ingredients in question, such as products made from gluten-free grains for celiac disease [80] or plant-based milk alternatives for lactose intolerance. In lactose intolerance, there is also the option of consuming lactose-containing foods in combination with the intake of the enzyme lactase (e. g., as tablets) [81].

Intensive “free from” Consumers

For the intensive “free from” consumers (cluster C4), all “free from”-claims are above average in importance. There is also an above-av-



erage orientation towards health and naturalness and a slightly below-average trust in food manufacturers.

The above-average naturalness-oriented intensive “free from” consumers attach above-average importance to the absence of additives/flavorings. In this context, available studies show that the absence of additives/flavorings perceived as negative and unnatural is characteristic of food-related naturalness from the consumer’s point of view [66, 15].

The intensive “free from” consumers also rate the absence of gluten, fructose, and lactose as quite important. This is despite the fact that, according to Román et al. [66], the presence of natural ingredients is an indicator of the naturalness of a food. According to Asioli et al. [2], the interpretation of “free from”-claims is subjective and depends on the consumer’s familiarity with the ingredient in question. Unfamiliar ingredients are more likely to be perceived as negative or risky [82]. As mentioned earlier, a considerable proportion of consumers cannot describe what gluten is [73]. It should be noted that consumer familiarity with gluten, lactose, and fructose was not recorded by the authors of the present study. Nevertheless, one explanation for the significance of the absence of gluten, lactose, and fructose could be that they are not considered natural ingredients by consumers in this cluster. Hartmann et al. [5] also show that naturalness preference is a predictor for the perception of gluten- and lactose-free products as healthier compared to regular alternatives.

The cluster of the intensive “free from” consumers is slightly more health-oriented than average. Against this background, an above-average relevance is attributed to the absence of additives/flavorings. Available studies show health-related concerns about additives on the consumer side [15, 48]. In addition, foods with additive-related “free from”-claims are considered healthier by a large proportion of consumers [35]. The absence of gluten, lactose, and fructose is given above-average importance by the intensive “free from” consumers. The percentage of individuals with gluten, fructose, or lactose intolerance in the cluster is 6.1%. Available studies show that the majority of individuals with gluten- and lactose-free diets do not suffer from a gluten- or lactose-related disease [83, 84]. Gluten- and lactose-free foods are perceived as healthier compared to conventional alternatives [5], although they do not have nutritional benefits [67, 68]. The importance of health orientation in the course of avoiding gluten and lactose in cases of gluten or lactose intolerance is also supported by available studies [27, 63]. Hartmann et al. [5] assume that the category affiliation of a product (with vs. without “free from”-claim) is an indicator for the healthier option for (health-oriented) consumers. The trust of the intensive “free from” consumers in manufacturers is slightly below average. According to the already cited study by Szűcs et al. [16], distrust in additive use among consumers is associated with activities aimed at reducing additive intake. In the food market, the range of gluten-, lactose-, and fructose-free products is growing [75, 6]. Everyday foods that otherwise naturally contain lactose, gluten, or fructose are considered healthier by consumers due to ingredient absence claims [5]. Despite the natural occurrence of these ingredients, consumers may assume that they are added substances (similar to additives) [5]. The finding that distrust of additive use is associated with consumer activities to reduce additive intake could be applied to these substances [16].

The group of intensive “free from” consumers has the highest average age. Román et al. [66] show that food-related naturalness becomes more important to consumers with increasing age. For intensive “free from” consumers, it is shown that the above-average naturalness orientation is accompanied by a high relevance of the absence of additives/flavorings (as an indicator of food-related naturalness [66]). It should be critically noted that the items used in the present study suggest that additives are problematic (♦ Table 2). Accordingly, the results could also be influenced by the study design. The absence of gluten, lactose, and fructose also has an above-average relevance in the group of the intensive “free from” consumers. According to Hartmann et al. [5], consumers might assume regarding foods that naturally contain lactose or gluten that these are unnatural, added product ingredients. Against the background of the high naturalness orientation of the on average oldest cluster, the high importance of the absence of gluten, lactose, and fructose could result. In this context, Perin et al. [27] also show that gluten-avoiding consumers are older than gluten-consuming consumers.

Limitations

The study has limitations. The restriction to two selected categories of “free from”-claims does not reflect the complexity of this form of labeling prevailing in the food market. The query of intolerances is based on self-reporting.

Conclusions

Overall, it appears that the “free from” additives/flavorings consumers differentiate between the categories of “free from”-claims. The other segments report high, medium, or low importance of all “free from”-claims. Intensive and moderate “free from” consumers show average to above-average general interest in “free from”-claims. Consumer information could help ensure that “free from” products are not perceived as a single category. Consumers should be encouraged to consider “free from”-claims in terms of personal relevance and make purchasing decisions based on this.

Additive/flavoring-related “free from”-claims are slightly to significantly more important than average for 74.6%. Consumer informa-



tion should provide information on the approval process for additives/flavorings and the health safety as a prerequisite for their approval. Due to the lack of legal regulations, consumer information on additive-related “free from”-claims should include information on the fact that substances with the same effect can be used despite the claims.

For 45.9%, the absence of gluten, lactose, and fructose is of average to slightly below-average importance, mostly for reasons other than intolerance. Central would be information on the natural occurrence of the ingredients as well as the non-necessity of the renunciation if no intolerances are present.

Further consumer research is needed, e. g., on products with fructose-related “free from”-claims. There is also a need for research on possible consumer overload due to the variety of “free from”-claims. Another research gap that needs to be filled is the linking of self-reported consumption of foods with “free from”-claims with objective purchasing data. Barcode scanning would be one possible approach to data collection. Product photos could be used to verify the presence of the “free from”-claims.

Conflict of Interest

The authors declare no conflict of interest.

Dr. Sina Nitzko^{1,2}**Dr. Laura H. Gertheiss¹**¹ University of Göttingen

Department of Agricultural Economics and Rural Development

Platz der Göttinger Sieben 5, 37073 Göttingen/Germany

² snitzko@uni-goettingen.de



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Questionnaire for the study

First, we would like to ask you to answer a few questions about yourself.

What is your gender? I am ...

- male
- female

In which year were you born? Please select your year of birth.

<input type="radio"/> 1943	<input type="radio"/> 1953	<input type="radio"/> 1963	<input type="radio"/> 1973	<input type="radio"/> 1983	<input type="radio"/> 1993
<input type="radio"/> 1944	<input type="radio"/> 1954	<input type="radio"/> 1964	<input type="radio"/> 1974	<input type="radio"/> 1984	<input type="radio"/> 1994
<input type="radio"/> 1945	<input type="radio"/> 1955	<input type="radio"/> 1965	<input type="radio"/> 1975	<input type="radio"/> 1985	<input type="radio"/> 1995
<input type="radio"/> 1946	<input type="radio"/> 1956	<input type="radio"/> 1966	<input type="radio"/> 1976	<input type="radio"/> 1986	<input type="radio"/> 1996
<input type="radio"/> 1947	<input type="radio"/> 1957	<input type="radio"/> 1967	<input type="radio"/> 1977	<input type="radio"/> 1987	<input type="radio"/> 1997
<input type="radio"/> 1948	<input type="radio"/> 1958	<input type="radio"/> 1968	<input type="radio"/> 1978	<input type="radio"/> 1988	<input type="radio"/> 1998
<input type="radio"/> 1949	<input type="radio"/> 1959	<input type="radio"/> 1969	<input type="radio"/> 1979	<input type="radio"/> 1989	<input type="radio"/> 1999
<input type="radio"/> 1950	<input type="radio"/> 1960	<input type="radio"/> 1970	<input type="radio"/> 1980	<input type="radio"/> 1990	<input type="radio"/> 2000
<input type="radio"/> 1951	<input type="radio"/> 1961	<input type="radio"/> 1971	<input type="radio"/> 1981	<input type="radio"/> 1991	
<input type="radio"/> 1952	<input type="radio"/> 1962	<input type="radio"/> 1972	<input type="radio"/> 1982	<input type="radio"/> 1992	

What is your highest school qualification?

- still at school
- certificate of secondary education
- general certificate of secondary education
- advanced technical college entrance qualification/university entrance diploma
- without graduation certificate

The following statements refer to nutrition and food purchasing. For each statement, please indicate the extent to which you agree with it.

	strongly agree	rather agree	partly agree	rather disagree	strongly disagree
I prefer natural foods.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have confidence in the producers of food.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I prefer natural products, i. e., products without additives. ¹	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I rely on information that food companies provide about their products.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To me the naturalness of the food that I buy is an important quality. ²	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food companies provide consumers with honest information about the manufacture of their products. ³	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I prefer less processed foods.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

¹ the item was taken from Grunert et al. [1], used in a modified form; ² the item was taken from Grunert et al. [1]; ³ the item was taken from Bergmann [2], used in a modified form

The following statements refer to nutrition and health. For each statement, please indicate the extent to which you agree with it.

	strongly agree	rather agree	partly agree	rather disagree	strongly disagree
I consider myself very health conscious. ¹	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I rarely eat unhealthy things. ²	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I always eat a healthy and balanced diet. ²	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other people pay more attention to their health than I do. ³	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

¹ the item was taken from Chen [3]; ² the item was taken from Diehl [4]; ³ the item was taken from Diehl [4], used in a modified form

Food products can be labeled with claims if certain substances are not contained or have not been used in the production process. Such “free from”-claims, which can be found on food products, are shown below:



Please indicate below how important each of the characteristics is to you when shopping for food.

	very important	quite important	moderately important	less important	not important
free from gluten	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
without flavor enhancers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
without sweeteners	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
free from lactose	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
without colorants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
without preservatives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
free from fructose	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
without flavorings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Now follows another question about yourself.

Do you suffer from a food allergy or food intolerance?

no

yes, I am allergic to or cannot tolerate the following substances: _____

References

1. Grunert KG, Brunsø K, Bredahl L, Bech AC: Food-related lifestyles: a segmentation approach to European food consumers. In: Frewer LJ, Resvik E, Schifferstein H (eds.): *Food, people and society: A European perspective of consumers' food choices*. Berlin: Springer 2001; 211–30.
2. Bergmann K: *Verbraucherverunsicherung und Convenience Food*. Verbraucherdienst 1998; 43: 420–4.
3. Chen MF: Attitude toward organic foods among Taiwanese as related to health consciousness, environmental attitudes, and the mediating effects of a healthy lifestyle. *Br Food J* 2009; 111: 165–78.
4. Diehl JM: *Skalen zur Erfassung von Ernährungs- und Gesundheitseinstellungen*. Gießen: Universität Gießen 2002.