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Eating Algae? Consumer Perception of Algae-Based Food in Austria

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Abstract

Algae-based foods are becoming more and more popular in recent years. They not only provide health benefits for the human organism but are also cheap and sustainable to produce. Therefore, algae-based novel food products hold potential for future expansion within the consumer market. On the basis of a discrete choice experiment, we assessed consumer perception and willingness to pay (WTP) of Austrian consumers for innovative food products made from algae on the example of algae crackers. To approximate the weighting of the product attributes origin, price, flavor, production method, and packaging, Choice Based Conjoint Analysis (CBCA) was applied (online survey; n = 301). In addition, socio-demographic data were collected and the preferences of the participants towards algae food products were determined using scales from literature. Subsequently, WTP for each product attribute was approximated based on the outcome of the CBCA.
Results of the CBCA show that the attribute "production method" is the most important attribute with an overall importance of 26.7% (maximum part worth utility for the attribute level "organic"), followed by price (25.6%; as expected, the lowest price has the highest part worth utility), origin (20.6%; maximum part worth utility for domestic origin), packaging (17.3%; paper packaging) and taste (9.8%; almost no differences between "spicey", "salt", "sweet"). Based on these results, the overall WTP was assessed: +1.90 € for products produced in Austria compared to products imported from the EU; +2.42 € for organically produced and +1.44 € more for paper packaging (in comparison to plastic packaging). Altogether, the present study shows that in general algae-based food products are positively perceived by consumers; the findings are roughly in line with previous studies from literature, with some interesting differences—e.g., higher WTP for organic algae-based food compared to similar studies where regional production was evaluated to be of higher importance. Therefore, it is expected that innovative algae foods have significant potentials in today's consumer food market; however, food producers should consider the expectations and perceptions of consumers in order to be able to successfully introduce novel algae food products in this—at least up to now—niche market.

Keywords: Algae foods, consumer behavior, Choice Based Conjoint Analysis, novel food, willingness to pay, niche market.

1 Introduction

Plant-based proteins are the main source of protein for food, but in general, meat consumption is raising on a global level. Microalgae-based proteins could be a reliable source to fulfil the population's need for protein and could be a "game changer" to the global trend towards more and more animal based nutrition. Microalgae-based proteins have some important advantages compared to established (plant-based and animal-based) protein sources such as lower land requirements, usage of non-arable land for cultivation, less freshwater usage, and the potential to be produced in seawater (Caporgno & Mathys, 2018).
There is already a market for products with health-promoting properties existing, triggered by new insights into the relationship between nutrition and health (Tuorila & Hartmann, 2020). However, the market introduction of

new food products are also connected to significant barriers, for instance potentially arising for not being approved by regulatory authorities (Caporgno & Mathys, 2018). Another problem is probably food neophobia, which is seen as the general skepticism of consumers towards novel foods (Henriques et al., 2009). To overcome food neophobia, researchers have found that the most important factor in creating familiarity is direct exposure to a food; the theoretical knowledge about a product is only of secondary importance (Tuorila & Hartmann, 2020). Furthermore, Tuorila and Hartmann (2020) found out that men are a little more neophobic than women and older people are more prone to neophobic behavior than younger people. Indicators for the demand of the consumer for a certain product could be price premiums, where the consumer pays an excess price which is justified by the personal value for the product (Krystallis & Chryssohoidis, 2005). Value can be defined as the evaluation of an experience with a product or service, based on all the benefits and disadvantages associated with it (Le Gall-Ely, 2009; Wertenbroch & Skiera, 2002).

This is reflected in willingness to pay (WTP) for novel food. Confirming Mcfarlane and Pliner (1997), the relative willingness to try novel food increased linearly with age. This might be shown on the example of organic food with additional ethical characteristics such as animal welfare, biodiversity or fair prices for producers. Zander and Hamm (2010) conducted a study with participants from Austria, Switzerland and Germany. 6 % of consumers chose a low-priced organic product without additional value and an overall WTP of at least 20 % for added ethical properties of organic food. This example clearly shows that alternative, more sustainable food products might result in higher WTP and market share, if consumers understand and appreciate the food products. To find answers for algae food products, this study intended to answer the following research questions:

1. *How important are selected product attributes for algae food products for consumers (including the utility of attribute levels)?*
2. *How far are consumers willing to pay a price premium for selected characteristics of an algae food product?*

2 Material and Methods

In order to approximate the importance of algae food product characteristics, a conjoint analysis approach is applied, also to consequently approximate the WTP. A Choice Based Conjoint Analysis (CBCA) is generally applied in the marketing sector in the areas of pricing, product development, and aspects of market segmentation. The method can be used for comprehensive practical applications such as optimal product or service design, price determination, or preference determination (Baier & Brusch, 2009). Among other methods, the CBCA is also in popular use for surveys in current consumer food studies (Anabtawi et al., 2020; Meixner & Katt, 2020; Weinrich & Elshiewy, 2019). Studies using CBCA examine the preference and WTP for meat substitutes based on microalgae (Weinrich & Elshiewy, 2019). Other studies deal with the health and safety of food, such as those by Anabtawi et al. (2020) who researched the perceived healthiness of food items and the traffic light front of pack nutrition labelling or assessing the impact of COVID-19 on consumer food safety perceptions (Meixner & Katt, 2020). Further publications used CBCA to observe the development of new products (van Kleef et al., 2005), the acceptance of functional foods (Annunziata & Vecchio, 2013), or novel bread, milk and meat food items (Cox et al., 2011). Additionally, CBCA is often used in combination with other quantitative and qualitative research methods such as cross-sectional surveys, multi-item scales, laddering interviews, and cluster analysis (Anabtawi et al., 2020; Annunziata & Vecchio, 2013; van Kleef et al., 2005; Weinrich & Elshiewy, 2019).

Concerning WTP, Krystallis and Chryssohoidis (2005) revealed that the WTP measured by a conjoint analysis is considered more realistic than in methods where consumers are directly interviewed. Also Meixner and Katt (2020) and Weinrich and Elshiewy (2019) primarily used this methodology in their research to determine consumers' WTP. Hofstetter et al. (2020) and Miller et al. (2011) discuss how WTP can be measured most effectively and which methodological approach is best suited for which context Hofstetter et al. (2020) argue that both methods, dichotomous-choice as indirect single question approach and CBCA as indirect multiple question approach, can be applied to individual features of a product.

The stages of the CBCA usually consist the following steps: (I) establishing attributes; (II) assigning attribute levels; (III) designing the choice sets; (IV) generating and pre-testing the questionnaire; (V) Analyzing the data Mangham et al. (2009). Because of the good comparability and similarity to products already established on the Austrian market, the research product within this study are *algae crackers*. These are dried and pressed microalgae that can be refined with spelt flour, linseed, pumpkin seeds, amaranth and other natural ingredients. The research design of this work is based on the specifications of Weinrich and Elshiewy (2019).

Step (I) and (II): The attributes and attribute levels of these algae crackers consist of (1) origin: "Produced in Austria" and "Produced in the EU". (2) The price attribute was defined in accordance to the study by Weinrich and Elshiewy (2019), the prices used in this experiment 2.19 €, 2.79 €, 3.39 € and 3.99 € (each for a 200-gram pack). (3) We also included the attribute "flavor" (natural, salty and spicy based on the flavor varieties for algae

crackers offered in Austria). (4) The attribute "production method" is a usual attribute in CBCA food studies, defined as "organic" and "conventional". Previous studies have already shown a close connection between locally as well as organically produced food with sustainability in the perception of consumers (Hempel & Hamm, 2016; Weinrich & Elshiewy, 2019; Zepeda & Deal, 2009). (5) Finally, we included two important packaging opportunities for algae crackers: plastic and paper packaging (Raheem, 2013). Table 1 gives an overview over the included attributes and attribute levels. Furthermore, to keep the study design realistic, forbidden product attribute combinations (e.g., organic at lowest price level) were included (Table 2).

Table 1. Examined attributes and their characteristics.

Attributes	Attribute levels
Origin	1. Produced in Austria 2. Produced in EU
Price	1. 2.19 € 2. 2.79 € 3. 3.39 € 4. 3.99 €
Flavor	1. Natural 2. Salt 3. Spicy
Production method	1. Organic 2. Non-organic
Packaging	1. Plastic 2. Paper

Table 2: Prohibited combinations of characteristics in profile design.

Forbidden combinations	Origin	Price	Production method
Combination 1	produced in Austria	2.19 €	organic
Combination 2	produced in EU	3.99 €	conventional

Step (III): Consequently, out of 96 possible combinations (possible products), and considering the unused combinations, 10 different profiles were generated by means of the Microsoft add in "XLSTAT V2020.3.1.1" (Table 3) (reduced CBCA study design). In general, the number of profiles must always be lower than the number of comparisons and the number of profiles per comparison (XLSTAT, 2020).

Table 3: Stimuli design with XLSTAT.

Observations	Origin	Price	Flavor	Production method	Packaging
Profile 1	produced in EU	3.99 €	salty	organic	paper
Profile 2	produced in Austria	2.19 €	salty	conventional	plastic
Profile 3	produced in EU	2.19 €	natural	conventional	paper
Profile 4	produced in Austria	3.39 €	natural	organic	paper
Profile 5	produced in EU	2.19 €	spicy	organic	plastic
Profile 6	produced in EU	3.39 €	spicy	conventional	plastic
Profile 7	produced in Austria	2.79 €	salty	organic	plastic
Profile 8	produced in EU	2.79 €	natural	conventional	plastic
Profile 9	produced in Austria	3.99 €	natural	conventional	plastic
Profile 10	produced in Austria	2.79 €	spicy	conventional	paper

In accordance with the CBCA conducted by Weinrich und Elshiewy (2019), 12 choice sets of 4 stimuli each and an additional "no-choice" option are presented to participants. The possibility to choose the "no-choice" answer provides more flexibility. The respondents do not feel forced to choose between the given options; this is definitely closer to real shopping behavior where consumers tend to not to buy a food product if the presented alternatives are not fulfilling their demand. For instance, the choice 1 consisted of the following profiles: Choice 1: profile 2, 2: profile 6, 3: profile 10, 4: profile 7 and the no choice option (0) (see Appendix for graphical design and trial plan).

Data were collected via an online survey in 2021. The questionnaire including the graphically designed choice were developed by means of the online platform lime survey. In accordance with Weinrich und Elshiewy (2019), who used a minimum sample size of approximately 300 participants per country (Germany 315, Netherlands

310, France 315), the intended sample size for Austria was set at 300 as well. After a pre-test, a total of 451 participants delivered data, 301 were successfully finished and fulfilling all requested pre-conditions (responsible for shopping in the family, living in Austria). After eliminating some more data sets (e.g., due to consistently using the no-choice option), 278 cases could be used to approximate CBCA part-worth utilities. The approximations were done applying a Hierarchical Bayes (HB) approach comparable to usual CBCA studies (Meixner & Katt, 2020). "[R]ecent advances in Bayesian estimation make the estimation of these models computationally feasible, offering advantages in model interpretation over models based on indirect utility, and descriptive models that tend to be highly parameterized" (Chandukala et al., 2008). Via this approach it is possible to approximate individual part-worth utilities.

3 Results

The following CBCA analysis only refers to the final sample size of 278. The sample structure is not corresponding to the overall Austrian population (more females, younger, urban, higher educated; Table 4). The approximations deliver non-transferable results, representativeness is limited (convenience sample).

Table 4. Demographic profile of respondents.

		Sample valid %	Austria % [a]
Gender	Male	28	51
	Female	72	49
Age	up to 29	72	33
	30 to 44	21	20
	45 to 59	4	23
	60 and older	3	24
Place of residence	Rural	20	47
	Urban	80	53
Education	Compulsory school	3	18
	Apprenticeship/middle school	31	49
	High school diploma, university	66	33
Income per month	Mean income	estimated 1760 to 2185	1887

N = 278; [a] Statistics Austria; https://www.statistik.at

Table 5: Arithmetic mean values of the consumer preference statements

Statement		Statement	Arithmetic mean
S1	General WTP	I would also be prepared to pay higher prices for food made from algae.	4.08
S2	WTP for regional prod.	I would spend more money on algae food that was produced regionally.	5.24
S3	WTP for organic prod.	I would spend more money on algae food that was produced organically.	5.18
S4	Vegetarian / vegan diet	I think that a vegetarian or vegan diet is beneficial for the human organism.	5.00
S5	Price	I think meat substitutes made from algae are too expensive.	4.09
S6	Texture/Taste	I think I would not like the texture or taste of algae food products.	3.32
S7	Health	I believe that the consumption of algae food has a positive effect on my health.	5.06
S8	Appearance	The appearance of algae food would be important to me.	4.61
S9	Packaging	The packaging of algae food would be important to me.	4.95
S10	Variety	When buying algae food, it would be important for me to have a wide choice.	4.27
S11	Sustainability	I believe that the consumption of algae food has a positive impact on the environment and climate.	5.45
S12	Substitutability	I think food made from algae is a good meat substitute.	4.21
S13	Novelty	I am interested in new and innovative foods.	5.66
S14	Curiosity	I find food from algae an exciting topic that interests me personally.	5.02
S15	Preparation	I do not know how to prepare meals with food made from algae.	5.20
S16	Future prospect	I believe that the consumption of algae food in Austria will increase in the coming years.	4.89

1 = do not agree at all … 7 = very much agree

At the beginning of the survey, the respondents were asked to indicate their agreement with selected statements concerning algae food products on a scale from 1 (total disagreement) to 7 (total agreement). The respective outcome can be taken from Table 5. In general, the perception of respondents concerning algae food are mostly on an intermediate level. However, as we can learn from the first three items (Statements S1 to S3), the differences in the agreement of the respondents seem to be mainly due product characteristics (intermediate WTP for algae food products; much higher for regional/organic algae food).

In general, respondents are quite interested in novel food (Statement S13); algae food is considered to be a rather sustainable (S11) and also healthy (S4 and S7) food alternative. Besides texture/taste (S6), there seem to

be no extreme tendency in the answers of the respondents (respondents mostly reject the statement that they will not like the texture or taste of algae food products. It will be interesting to compare these results with the outcome of the CBCA; e.g., if there is a correlation between the acceptance of higher prices and the approximated WTP according to CBCA.
As mentioned above, the approximations of the importance of the different product attributes and of the part-worth utilities of each attribute levels were done on an individual level per respondent by means of Hierarchical Bayes (HB) estimations. The most important attributes responsible for the choices of the respondents are the production method (0.267) and price (0.256). Origin (0.2062) and packaging (0.173) are also quite important, flavor seems to be less relevant (0.098). However, the results are quite heterogeneous considering the minimum and maximum values and standard deviation in Table 6 (this issue would require further considerations, e.g., cluster analysis; however, we refrain from including the respective results in this contribution as it leads us beyond the study goal).

Table 6. Importance of attributes.

Attribute	Minimum	Maximum	Mean	Standard deviation
Origin	0.0012	0.5959	0.2062	0.1051
Price	0.0212	0.8163	0.2555	0.1400
Flavor	0.0047	0.5361	0.0981	0.0645
Production method	0.0034	0.5562	0.2671	0.1386
Packaging	0.0002	0.5044	0.1731	0.1212

N = 278

Concerning the part-worth utilities of the attribute levels, the results are in accordance with our expectations. Produced in Austria, the lowest price level (2.19 €), and organic production are much better evaluated compared to production in EU, highest price (3.99), and conventional production. Here too, the distribution of part-worth utilities indicates that a further analysis of the individual approximations might be necessary (Table 7).

Table 7. Part-worth utilities of attribute levels.

Attribute	Minimum	Maximum	Mean	Standard deviation
Origin—produced in Austria	-0,759	3,499	1,603	0,931
Origin—produced in EU	-3,499	0,759	-1,603	0,931
Price—2,19	-1,648	5,167	1,601	1,351
Price—2,79	-0,951	2,706	1,140	0,719
Price—3,39	-3,639	1,589	-1,305	1,125
Price—3,99	-3,325	1,419	-1,435	0,835
Flavor—natural	-1,996	1,796	0,121	0,611
Flavor—salty	-1,518	1,833	-0,084	0,562
Flavor—spicy	-2,219	3,514	-0,037	0,892
Production method—conventional	-4,459	1,220	-2,043	1,309
Production method—organic	-1,220	4,459	2,043	1,309
Packaging—paper	-0,748	3,446	1,217	0,905
Packaging—plastic	-3,446	0,748	-1,217	0,905

N = 278

To approximate WTP for changed attribute levels (e.g., Austrian origin instead of EU), theoretical considerations are based on compensation via price changes. If the overall part-worth utility of the product increases, the price of the product can increase as well to reach the same utility level (and vice versa). The difference equals then the approximated WTP confirming formula (1). In other words, consumers will be willing to pay more to obtain one superior attribute value instead another inferior attribute value (Breidert & Hahsler, 2007).

$$WTP = \frac{Difference\ of\ relevant\ price\ levels}{Part\text{-}worth\ difference\ of\ relevant\ price\ levels} \times Part\text{-}worth\ gain\ (loss)\ of\ attribute \quad (1)$$

Mean part-worth for production in Austria equals 1.603, production in the EU is –1.603. Their difference is 3.206. Out of the estimation of part-worth utilities of price levels, WTP can be approximated by means of the following formula (2). For all other attributes, WTP approximations are similar.

$$WTP(Origin_{EU \rightarrow AT}) = \frac{3.99-2.19}{1.601-[-1.435]} \times 3.206 = +1.90\ € \quad (2)$$

In our study, WTP for origin, production method, and packaging are rather high considering the overall price levels (between +1.90 € to +2.42 € if the superior attribute level is selected). The approximation was only done on an aggregate level, as linearity is required which is not always the case on an individual level. Even though WTP might be overestimated, it clearly shows that also in the case of microalgae, origin and production method are of importance which might be surprising for this non-domestic product category.

Table 8. Willingness to pay.

Property characteristics	WTP [a]
Origin—produced in Austria instead of EU	+1.90 €
Production Method—organic instead of conventional	+2.42 €
Packaging—paper instead of plastic	+1.44 €

[a] approximated on an aggregated level (basis: means of total sample)

As we can see from Table 9, there are some significant correlations of selected perception statements (only WTP relevant statements S1 to S3 were used for this analysis). If the price attribute is more important for respondents (price sensitive buyers), the self-assessed willingness to pay a price premium is lower; the correlation coefficients (Pearson's *r*) are all negative and significant; in particular, *r* reaches an intermediate level for WTP for regional and organic food (*r* = -0.338 and -0.326, respectively). For production method attribute the opposite is true: the more important the production method is, the higher the self-assessed WTP confirming S1 to S3 might be. *r* amounts to 0.272, 0.220, and 0.399, respectively; all significant.

Table 9. Correlation between WTP-statements and CBCA approximations.

		Price levels				Importance attribute		
		2.19 €	2.79 €	3.39 €	3.99 €	origin	prod. method	price
S1: I would also be prepared to pay higher prices for food made from algae.	Pearson's r Sig. N = 265	-0.134* 0.029	0.183** 0.003	0.114 0.063	-0.093 0.130	0.058 0.348	0.272** 0.000	-0.178** 0.004
S2: I would spend more money on algae food that was produced regionally.	Pearson's r Sig. N =268	-0.330** 0.000	0.172** 0.005	0.251** 0.000	0.048 0.429	0.175** 0.004	0.220** 0.000	-0.338** 0.000
S3: I would spend more money on algae food that was produced organically.	Pearson's r Sig. N = 266	-0.310** 0.000	0.226** 0.000	0.259** 0.000	-0.039 0.525	0.012 0.850	0.399** 0.000	-0.326** 0.000

* Sig. < 0.05; ** Sig. < 0.01

Including the price levels into the analysis, this interpretation vastly holds: The more price sensitive repsondents are, the less they agree to the WTP statements S1 to S3.

4 Discussion and Conclusion

The sample structure of this study do not correspond to the Austrian population as they were collected by means of a convenient sample; they can therefore not be considered to be representative (Ball, 2019). Compared to our study, Weinrich and Elshiewy (2019) offer better representativeness and data quality with a significantly larger sample (n = 940). The sample size is however also due to the fact that Weinrich and Elshiewy (2019) compare three countries (Germany, Netherlands, France). The sample size for the present study is therefore more or less comparable to this study. The lack in data quality is however reducing the quality of our outcome, in future research representativeness should be reached.

Considering the outcome of the perception part of the study (agreement to statements S1 to S16), it is plausible to consider the respondents of this study as above average ready to accept novel food. Therefore, the following conclusion that are based on a convenience sample might be true for parts of the consumers (interested in and ready to adopt food innovations/novel food products).

There has been a five-fold increase in microalgae production in food and feed since the early 2000ies (Vigani et al., 2015). However, it is still a niche market and the commercial production of microalgae as an alternative source of proteins, fatty acids, and carbohydrates is still an industry in its infancy (Vigani et al., 2015). Nevertheless, we see that improvements in the production technology can be implemented to enable a more sustainable microalgae production in the future (Grahl et al., 2018). These market developments might be further

boosted as the sector for microalgae products, either as final product or biomass, is expanding with start-ups and big enterprises by indicating their interest on a global scale (Caporgno & Mathys, 2018). If we accept that the respondents in our study have a rather positive attitude and perception of microalgae to be implemented in human nutrition, the respective results are rather valid for the core target group within this market than the general population. We can see that at least for this target group, algae-based food products should be produced regionally and organically. In this case, the products can be sold at a significant price premium. This is in accordance with Weinrich and Elshiewy (2019). We approximated an even higher WTP for organic production compared to regional production, a slight contradiction to literature (Hempel & Hamm, 2016; Zander & Hamm, 2010; Zepeda & Deal, 2009). However, to identify and evaluate product characteristics that are relevant for the broader public, or, more generally speaking, reaching the mass market with novel food based on microalgae, more in-depth research implementing appropriate empirical designs (such as CBCA in our study) and applying high-quality data will be beneficial. Via this approach, it should be possible to convince consumers to integrate microalgae into their daily diet and to overcome the refusal or avoidance to eat novel food; the latter is in general known as food neophobia, one of the most important obstacles for novel food products to be successful in the food market.

References

Anabtawi, O., Swift, J. A., Hemmings, S., Gertson, L., & Raaff, C. (2020). Perceived healthiness of food items and the traffic light front of pack nutrition labelling: choice-based conjoint analysis and cross-sectional survey. *Journal of Human Nutrition and Dietetics*, *33*(4), 487–495. https://doi.org/10.1111/jhn.12741

Annunziata, A., & Vecchio, R. (2013). Consumer perception of functional foods: A conjoint analysis with probiotics. *Food Quality and Preference*, *28*(1), 348–355. https://doi.org/10.1016/j.foodqual.2012.10.009

Baier, D., & Brusch, M. (2009). Erfassung von Kundenpräferenzen für Produkte und Dienstleistungen. In *Conjointanalyse* (p. 311). Springer, Berlin, Heidelberg. https://doi.org/https://doi.org/10.1007/978-3-642-00754-5_1

Ball, H. L. (2019). Conducting Online Surveys. *Journal of Human Lactation*, *35*(3), 413–417. https://doi.org/10.1177/0890334419848734

Breidert, C., & Hahsler, M. (2007). Adaptive conjoint analysis for pricing music downloads. *Studies in Classification, Data Analysis, and Knowledge Organization*, *2006*, 409–416. https://doi.org/10.1007/978-3-540-70981-7_46

Caporgno, M. P., & Mathys, A. (2018). Trends in Microalgae Incorporation Into Innovative Food Products With Potential Health Benefits. *Frontiers in Nutrition*, *5*(July), 1–10. https://doi.org/10.3389/fnut.2018.00058

Chandukala, S. R., Kim, J., Otter, T., & Allenby, G. M. (2008). Choice Models in Marketing: Economic Assumptions, Challenges and Trends. In *Foundations and Trends in Marketing*. now Publishers Inc.

Cox, D. N., Evans, G., & Lease, H. J. (2011). The influence of product attributes, consumer attitudes and characteristics on the acceptance of: (1) Novel bread and milk, and dietary supplements and (2) fish and novel meats as dietary vehicles of long chain omega 3 fatty acids. *Food Quality and Preference*, *22*(2), 205–212. https://doi.org/10.1016/j.foodqual.2010.10.003

Grahl, S., Strack, M., Weinrich, R., & Mörlein, D. (2018). Consumer-Oriented Product Development: The Conceptualization of Novel Food Products Based on Spirulina (Arthrospira platensis) and Resulting Consumer Expectations. *Journal of Food Quality*, *2018*. https://doi.org/10.1155/2018/1919482

Hempel, C., & Hamm, U. (2016). How important is local food to organic-minded consumers? *Appetite*, *96*, 309–318. https://doi.org/10.1016/j.appet.2015.09.036

Henriques, A. S., King, S. C., & Meiselman, H. L. (2009). Consumer segmentation based on food neophobia and its application to product development. *Food Quality and Preference*, *20*(2), 83–91. https://doi.org/10.1016/j.foodqual.2008.01.003

Hofstetter, R., Miller, K. M., Krohmer, H., & Zhang, Z. J. (2020). A de-biased direct question approach to measuring consumers' willingness to pay. *International Journal of Research in Marketing*, *xxxx*. https://doi.org/10.1016/j.ijresmar.2020.04.006

Krystallis, A., & Chryssohoidis, G. (2005). Consumers' willingness to pay for organic food: Factors that affect it and variation per organic product type. *British Food Journal*, *107*(5), 320–343. https://doi.org/10.1108/00070700510596901

Le Gall-Ely, M. (2009). Definition, Measurement and Determinants of the Consumer's Willingness to Pay: A Critical Synthesis and Avenues for Further Research. *Recherche et Applications En Marketing (English Edition)*, *24*(2), 91–112. https://doi.org/10.1177/205157070902400205

Mangham, L. J., Hanson, K., & McPake, B. (2009). How to do (or not to do)...Designing a discrete choice experiment for application in a low-income country. *Health Policy and Planning*, *24*(2), 151–158. https://doi.org/10.1093/heapol/czn047

Mcfarlane, T., & Pliner, P. (1997). Increasing willingness to taste novel foods: Effects of nutrition and taste information. *Appetite*, *28*(3), 227–238. https://doi.org/10.1006/appe.1996.0075

Meixner, O., & Katt, F. (2020). Assessing the impact of covid-19 on consumer food safety perceptions—a choice-based willingness to pay study. *Sustainability (Switzerland)*, *12*(18), 1–18. https://doi.org/10.3390/su12187270

Miller, K. M., Hofstetter, R., Krohmer, H., & Zhang, Z. J. (2011). How should consumers' willingness to pay be measured? an empirical comparison of state-of-the-art approaches. *Journal of Marketing Research*, *48*(1), 172–184. https://doi.org/10.1509/jmkr.48.1.172

Raheem, D. (2013). Application of plastics and paper as food packaging materials - An overview. *Emirates Journal of Food and Agriculture*, *25*(3), 177–188. https://doi.org/10.9755/ejfa.v25i3.11509

Tuorila, H., & Hartmann, C. (2020). Consumer responses to novel and unfamiliar foods. *Current Opinion in Food Science*, *33*, 1–8. https://doi.org/10.1016/j.cofs.2019.09.004

van Kleef, E., van Trijp, H. C. M., & Luning, P. (2005). Consumer research in the early stages of new product development: A critical review of methods and techniques. *Food Quality and Preference*, *16*(3), 181–201. https://doi.org/10.1016/j.foodqual.2004.05.012

Vigani, M., Parisi, C., Rodríguez-Cerezo, E., Barbosa, M. J., Sijtsma, L., Ploeg, M., & Enzing, C. (2015). Food and feed products from micro-algae: Market opportunities and challenges for the EU. *Trends in Food Science and Technology*, *42*(1), 81–92. https://doi.org/10.1016/j.tifs.2014.12.004

Weinrich, R., & Elshiewy, O. (2019). Preference and willingness to pay for meat substitutes based on micro-algae. *Appetite*, *142*(October 2018), 104353. https://doi.org/10.1016/j.appet.2019.104353

Wertenbroch, K., & Skiera, B. (2002). Measuring consumers' willingness to pay at the point of purchase. *Journal of Marketing Research*, *39*(2), 228–241. https://doi.org/10.1509/jmkr.39.2.228.19086

XLSTAT. (2020). *Choice Based Conjoint (CBC) in Excel tutorial*. Addinsoft.

Zander, K., & Hamm, U. (2010). Consumer preferences for additional ethical attributes of organic food. *Food Quality and Preference*, *21*(5), 495–503. https://doi.org/10.1016/j.foodqual.2010.01.006

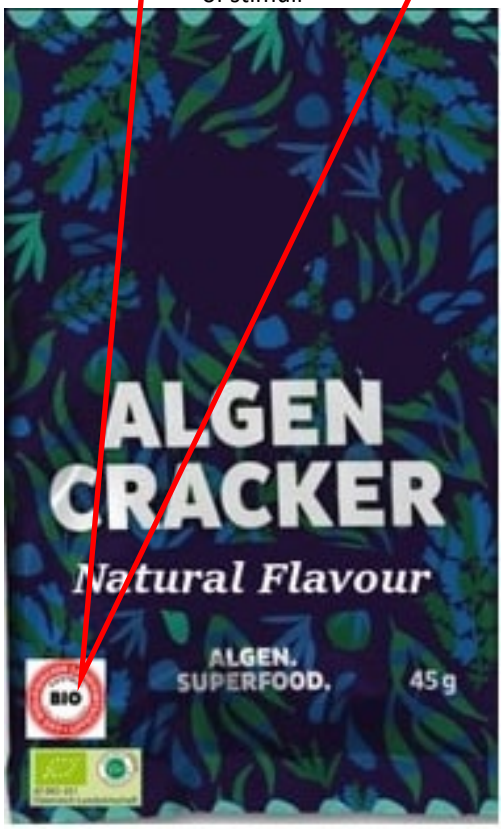
Zepeda, L., & Deal, D. (2009). Organic and local food consumer behaviour: Alphabet theory. *International Journal of Consumer Studies*, *33*(6), 697–705. https://doi.org/10.1111/j.1470-6431.2009.00814.x

Appendix — Graphical design & trial plan

Product labels used in CBCA design

AMA seal of quality | AMA organic seal | EU organic seal from EU agriculture | EU organic seal from Austrian agriculture

Graphical design of stimuli



Example choice (incl. no-choice option)

Trial plan for conjoint analysis with XLSTAT

Comparisons	Choice 1	Choice 2	Choice 3	Choice 4	Choice 5 “no-choice”
Comparison 1	2	6	10	7	0
Comparison 2	9	3	5	4	0
Comparison 3	4	5	1	6	0
Comparison 4	2	7	8	3	0
Comparison 5	3	4	2	1	0
Comparison 6	5	7	6	8	0
Comparison 7	7	1	10	5	0
Comparison 8	8	2	4	6	0
Comparison 9	10	8	7	4	0
Comparison 10	6	1	3	9	0
Comparison 11	5	10	9	2	0
Comparison 12	1	9	8	10	0