THE EFFECT OF COMMUNICATION ON THE PERCEIVED NATURALNESS OF FOOD ADDITIVES

Bachelor Thesis

Author:	Alexander Ligthart
Student Number:	960426518090
Supervisor:	Arnout Fischer
Co-reader:	Jannette van Beek
Date:	30-05-2017
Institution:	Wageningen University
Chair group:	Marketing and Consumer Behaviour

Table of contents

Abstract

Food related health risks are becoming increasingly important among consumers. The consumer wants food to be more natural and organic and there is a general aversion towards food additives, even though scientists agree that additives in normal amounts can do no harm. These days there is a lot of media attention for food additives and E-numbers in particular. The aim of this research is to investigate the difference in perceived naturalness of food additives when communicated in different ways and the formed attitude towards the product containing those additives. The research contains an experiment in the form of an online survey. The experiment divides the respondents in four groups and shows the four different ways of communicating the additive, from natural to unnatural. These four classes of food additives decrease in perceived naturalness, but only the fourth class significantly differs from the other three. The perceived naturalness of the additive only partly influences the formed attitude towards the product containing the additive. The buying intention is not influenced at all.

Introduction

Consumers are getting more aware of their choice of food and its content. Also, they are getting more interested in health risks regarding food (Hauser et al. 2011). Food additives play an important role in this as they are gaining importance among consumers' food safety concerns (Tarnavölgyi, 2003). Food additives are substances added to food for reasons like enhancing taste or improving preservability. Since 1962, the European Food Safety Authority (EFSA) has been assigning E-numbers to these additives. E-numbers are codes for food additives which are permitted by the EFSA and proven to be safe enough. People tend to have an aversion to food additives, especially when they are communicated through an E-number. The public anxiety over food, mostly caused by food incidents and escalating media attention, is called food scare. Food scare is so prevalent among consumers that it influences the decisions made by the EFSA (Knowles & Moody, 2007). There is a lot of commotion and a negative atmosphere around E-numbers, but there is very little knowledge among consumers about these E-numbers (Tarnavölgyi, 2003). Some consumers say they prefer 'pure' food, without additives, which means that they are not aware that a lot of food additives are derived from e.g. their fruits and vegetables (Paans, 2013). So when do consumers think an additive is pure or natural and how important is this for them?

There is a lot of media attention for food additives and their naturalness, but the scientific literature on this subject is limited. Lots of internet forums and websites revolve around subjects like 'learning to cook without additives' and 'avoiding E-numbers in your diet'. This implies that not all consumers understand what food additives actually are. Many E-numbers actually are substances that are naturally present in certain products, however when these substances are added to another product, they are assigned an E-number.

Just recently, Honig removed 5 E-numbers from one of their products, in order to satisfy the consumers' wants. Nutritionists claim that the distrust of consumers is odd, because a substance only receives an E-number when it had been tested extensively. After the E-number is given to the product, the EFSA re-investigates the substance every couple of years (NRC, 2016). According to professor Martijn Katan (2016), the distrust of consumers in E-numbers and research on this area exists because people can't assess the research themselves, making them vulnerable for myths around E-numbers.

Scientists generally agree that additives with an E-number are safe to consume, unless when consuming absurd amounts (NRC, 2014). Apparently, the distrust of consumers regarding E-numbers is large enough to cause some companies to adjust their product composition. Evans et al. (2010) show in their research that 'E-numbers are always perceived to be less natural than the same preservatives described by chemical and common names'. But what about other ways of communicating additives? Devcich et al. (2010) show that people with food worries prefer natural food additives over synthetic ones. The goal of this research is to find out if there is any significant difference in perceived naturalness of certain food additives and if is there an effect on the consumers attitude towards the product.

The research question of this study is formulated as follows: '*To what extent do consumers perceive food additives as natural when they are communicated in different ways and how does this affect the consumer's attitude towards the product containing these additives?*'. This is an important question for companies which try to increase their revenues, since higher perceived naturalness leads to higher buying intention (Devcich et al., 2010). If this study shows significant results on consumer buying intention, food producers can adapt their products in accordance to these results and profit from the increase in sales. Because consumers do not perceive all food additives in the same way

(Bearth, Cousin & Siegrist, 2014) this study will distinguish four types of communicating a single food additive; the natural product, an extract of a natural product, a lab-made version identical to the natural product and the E-number of the additive.

Theoretical background

In order to find out how the perceived naturalness of the four classes of additives differs, we first need to understand what perceived naturalness means. Consumers still appear to think products generally are better when they are natural and that additives are bad (Brockman & Beering, 2011). According to Siegrist (2011), perceived naturalness is a factor that influences the acceptance of new food technologies. This could mean that additives of the first class 'natural product' are preferred over less natural variants. In a study carried out in the United Kingdom respondents were shown 19 different food additives. About half of the respondents did not recognize at least two third of the additives. Additives communicated in a 'natural' way were not recognized as possible food additives by the respondents. Since additives are generally seen as bad, (Brockman & Beering, 2011) this would mean that additives in the class 'natural product' are perceived as less bad and more natural than the same additives communicated in a different way. A study carried out by Dangol et al. (2013) investigates the preference and perceived naturalness of office room LED lighting. The experiment was set up with one 'standard' lighted room, with fluorescent lamps, and one room with LED lightning. The room with LED lighting was both preferred and perceived as more natural, indicating a correlation between perceived naturalness and preference, thus acceptance. This might also be the case for food additives.

The second class of communicating additives is 'extract of a natural product'. Paans (2011) shows that consumers prefer 'pure' food. Here, 'pure' means as natural as possible, without human adjustments. Additives in the second class 'extract of a natural product' are expected to be perceived as less natural than the natural product because there is some human adjustment done to the product.

The results of different studies about naturalness combined with the knowledge that consumers prefer pure food, lead to the following hypothesis:

Hypothesis 1: Additives in the class 'extract of a natural product' are perceived as less natural than additives in the class 'natural product'.

In this study, the 'lab-made version of an additive identical to the natural product' is classed as artificial. The natural product and the extract from the natural product are seen as natural additives. There are different ways to obtain the same substance. For example, citric acid can be made by extracting it from citrus juice but the same substance can also be created artificially. Citric acid is easier for companies to obtain artificially, but this is likely to be perceived as less natural by the consumer. If this difference in perceived naturalness is significant and influences the buying intention, companies can adapt their production methods accordingly. While there is no strict difference between natural and artificially made food additives, the consumer does differentiate between them (Bearth, Courin & Siegrist). Additives identified as 'artificial' evoke a lot of criticism, as people have the perception that lab-made chemicals are more dangerous than chemicals naturally present in our food (Brockman & Beering, 2011). This may be a reason for lab-made additives to be perceived as less natural than natural variants. Shim et al. (2011) ask respondents in their research about the food additives that they find concerning. The most concerning additives found were preservatives, colorants and artificial sweeteners. These additives are mostly obtained artificially, which is another reason to expect lower perceived naturalness on the lab-made food additives. In an interview with the Dutch representatives of the award winning French aroma producer Prova, it is

stated that the company is in a transition from supplying 'Natural identical' (artificial) products to supplying 'Natural' products. They claim that this is what consumers want nowadays. They say that there is a huge upcoming demand for healthy, organic and natural food. It is doubtful if the terms 'natural' and 'organic' are directly linked to healthiness, since artificial additives with E-numbers are proven safe by the EFSA. However, in the end what matters for companies like Prova is what the consumer wants.

While food is the most important domain considering preference for naturalness, the preference actually holds for many other domains. For example, a study done by Kaplan & Talbot (1987) investigates the recreational destinations of different groups of people that live in the same kind of environment. Remarkably, the study shows that the places people generally visit for recreational purposes are places that resemble their natural environments. This also indicates that people, either consciously or unconsciously, prefer the natural. Rozin (2005) said that the preference for naturalness is largely due to moral or aesthetic reasons, rather than to the instrumental difference of the products. Li & Chapman (2008) later found out that there actually is a relation between the moral/aesthetic and the instrumental values for consumers and that instrumental value is also important. Consumers would not believe that certain naturally and artificially obtained substances were identical, even when they were told so. This stresses the distrust of consumers regarding the artificial. Nature and naturalness are concepts which are generally preferred and positively valued by consumers (Siegrist, 2008). For this reason, food advertisements are often associated with nature. 'Natural' and 'artificial' are seen as opposite terms so the 'naturalness' level would express the level at which something has no artificial influence (Machado, 2004). Consumers differentiate between these terms and generally criticize substances labelled as artificial.

These statements lead to the following hypothesis:

Hypothesis 2: Additives in the class 'lab-made version identical to the natural product' are perceived as less natural than additives in the class 'extract of a natural product'.

The fourth and final class used in this study to communicate the additive is 'the E-number of the additive'. A study by Tenbült et al. (2005) show that 'A genetically modified (GM) product that is perceived as more natural is more likely to be accepted than a GM product that is perceived as less natural'. Although this research is carried out on genetically modified food, this could also be the case for food additives, since it is known that E-numbers are perceived to be less natural than the same substances communicated with their common names (Evans et al., 2011). Connor and Siegrist (2010), who use Tenbülts' results, show in their study that there is a negative correlation between acceptance of gene technology and perceived naturalness. They also state that people are suspicious of new food and food technologies. If the consumer considers the adjustments made by humans on food additives as 'food technology' or 'new food', it could scare them and make additives be perceived as less natural. Evans et al. (2011) also claims that adding more additives leads to decreasing perceived naturalness. Any listing of content or processes tends to have a negative impact on natural ratings compared to a simple product name. These insights bring us to the following hypothesis:

*Hypothesis 3: Additives in the class 'E-number of the additive' are perceived as less natural than additives in the class '*lab-made version identical to the natural product*'.*

As stated before, the concepts 'natural' or 'naturalness' are generally seen as good. Rozin et al. (2014) show that the link between food technology and nature is important for consumers' acceptance of food, or in this case, consumers' acceptance of food additives in products. In another study by Rozin (2005), it is investigated how physical and chemical transformations affect the

perceived naturalness of products. An example of a common physical transformation is freezing water, a chemical transformation could be removing fat from milk. Where physical changes only have a significant effect on perceived naturalness in one of the two respondent groups, chemical transformations have a significant effect on all respondent groups. The same study also shows that even small amounts of food additives that have unnatural characteristics will have a negative effect on consumers' perceived naturalness. To summarize the three previously drafted hypotheses and to find out whether the four mentioned classes of additives are indeed descending in perceived naturalness, the following hypothesis is formulated:

Hypothesis 4: The four classes of communicating the same additive, are descending in perceived naturalness, from: 'the natural product' to 'an extract of a natural product' to 'a lab-made version identical to the natural product' to 'the E-number of the additive'.

Acceptance, attitude and buying intention

Regarding food, acceptance and naturalness are closely related topics. It is known that in the case of food technology, naturalness positively influences acceptance (Siegrist, 2010), and that the 'natural' in food is generally preferred (Paans, 2013). Acceptance can be defined as 'the act of taking something offered'. When an attribute of a food product is accepted more, the food product itself is more accepted too. Because additives are attributes of a food product, acceptance of food additives impacts the overall acceptance of the food product. A more positive attitude towards the food product will arise. There are a lot of factors that influence food acceptability, consumer expectations being an important one. Disconfirmed expectations for certain attributes of a product have a negative effect on the acceptability and thus the buying intention of this product (Cardello & Sawyer, 1992). Even though there is a general aversion towards food additives, many consumers do not really know which and how many food additives they actually consume. When consumers hear about possibly 'dangerous' additives in the media, this may have a negative effect on their food acceptability. The option of choice in food is also an important factor in acceptability. In a study by King et al. (2004), the effect of choice on food acceptability is measured. Respondents are given a choice based on flavor variations within foods. They had to choose which flavor they want to add to their food. There was a positive effect measured on acceptability of the food, when a choice was available. Assuming that the respondent will most likely choose the flavor which they perceive as most natural, a positive effect between the naturalness of the additive and the acceptability of the food product is expected.

It is assumed that when food products are accepted more, there is generally more buying intention. Buying intention can be defined as: 'the consumers' foreseeable behaviour in short-term future buying decisions' (Fandos & Flavián, 2006). This basically concerns which product the consumer will buy on his or her next shopping trip. Buying intention is a future projection of consumer behaviour, and is developed by attitudes. A positive attitude towards a product means that the product is accepted more, and that there will be more consumer buying intention. According to the theory of planned behaviour (TPB); 'attitudes towards behaviour together with subjective norms and perceived behavioural control lead to an individual's behavioural intentions', or in this case buying intentions (Ajzen, 1991). However, this study only focuses on the attitude towards a product, which is influenced by different attributes of a product. Subjective norms and behavioural control are left out. An attitude towards a product consists of different attributes. Examples of attributes of a food product are price, taste, volume and in this case food additives. As most food consists of multiple ingredients or additives, consumers attitudes towards these attributes are important. This seems in context with the Expectancy Value Model. Fishbein and Ajzen (2008) created the following Expectancy Value model.

Figure 1: Expectancy value model

$$A_o = \sum_{i=1}^{n} B_i E_i$$

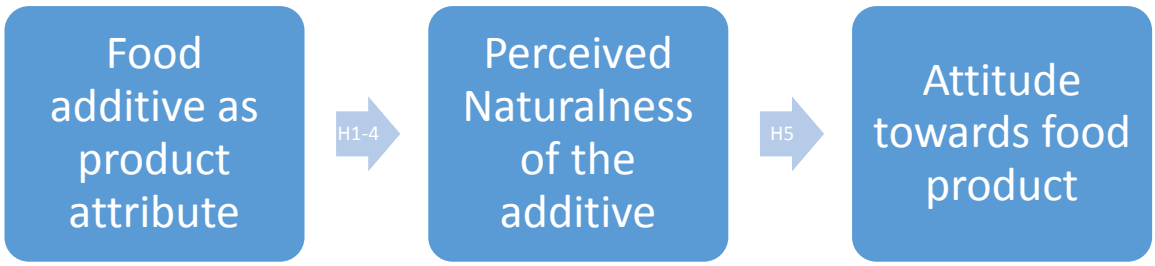
Ao = Attitude towards Object
Bi = Belief about Object
Ei = Evaluation of given Belief

The theory behind the model it is that consumers form attitudes towards products by evaluating the believed product attributes. In this case, additives are an attribute of a product. When a product rates favourably on certain product attributes that are important to consumers, the product itself rates more favourably. In food products, additives are very important attributes to consumers. There is a reason that most food packings are labelled with terms like 'no additives' and 'natural'. Consumers form their attitude towards a product by evaluating the attributes. In turn, this attitude has an influence on the buying intention and product acceptance. Each product attribute is evaluated separately. Because additives are an attribute of a food product, it implies that if food additives are negatively evaluated on naturalness, it can have a negative impact on the formed attitude of the product and thus on consumer buying intention of the food product. This leads to the following hypothesis:

Hypothesis 5: Higher perceived naturalness of food additives leads to a more positive attitude towards the food product containing the additives

For this study, the following conceptual model is suggested:

Figure 2: conceptual model



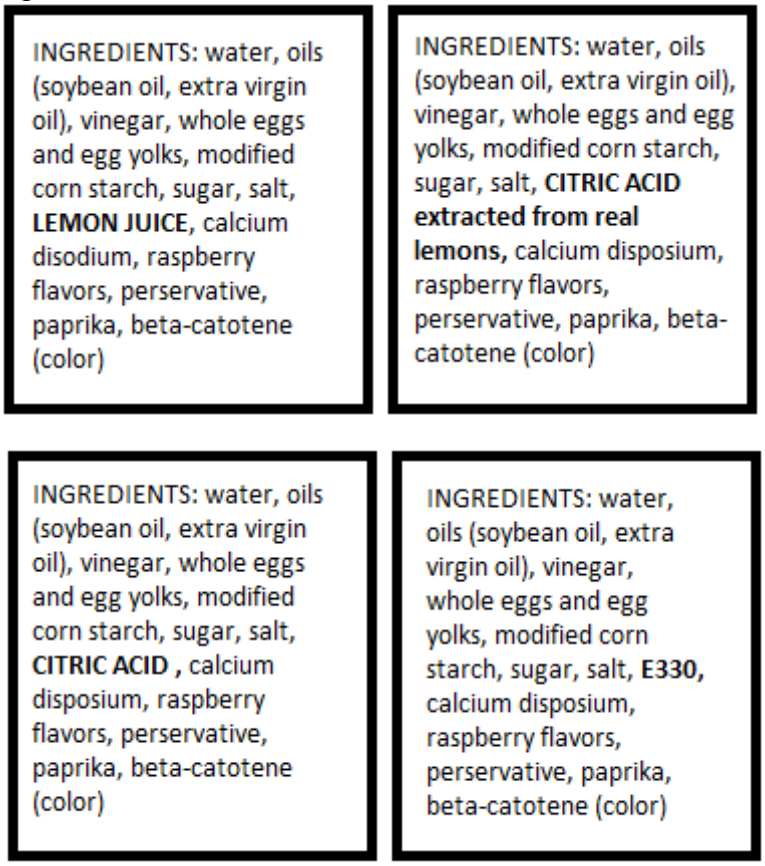
Method

To gather the data needed to answer the research question with corresponding hypotheses, an experiment in the form of an online survey was set up. The survey was made using the Qualtrics website. The respondents were equally and randomly divided into 4 groups. An online survey with four different designs was set up. The only difference was the picture of a food label shown during the survey, containing either 'the natural product', 'an extract of a natural product', 'a lab-made version identical to the natural product' or 'the E-number of the additive'. Citric acid was used as an example to visualize the four classes. Citric acid was used because it is well known and very frequently used in food products. The four classes applied to citric acid were:

- Lemon juice 1
- Citric acid extracted from real lemons 2
- Citric acid 3
- E330 4

The respondents were given numbers from 1 to 4 respectively, depending on which picture they were randomly assigned to.
In figure 3 are the pictures of the food labels with each one of the four different classes:

Figure 3: food labels



The additives in dispute were typed with capital bold letters. The respondents were asked questions about the additive, requiring a response on a 7-point scale. The 7-point scale was used for all questions. This way there were not too many options to choose from for hesitant respondents and enough variance in the results is expected. Other reasons for the use of this scale in this study are Ajzen's (2002) sample questionnaire on TPB about attitudes and Rozin's (2005) research on the 'natural', which were also both a 7-point scale. In order to get enough response, the questionnaire was put online on several Facebook pages. The questionnaire was up on Facebook for 5 days.

Participants

In total, 98 people filled out the online survey, equally and randomly divided over four groups. Three responses were deleted from the results, because the answers given were incomplete. Group 1 (lemon juice) had 25 respondents of which 10 were male and 15 female. Group 2 (citric acid extracted from lemons) had 22 respondents, 13 males and 9 female. Group 3 (citric acid) had 23 respondents of which 17 were male and 6 were female. Group 4 (E330) had 25 respondents, of which 14 males and 11 females. In total, of the 95 participants, 44 were male and 41 were female. The participants age ranged from 17 to 58, with mean 24 and standard deviation 8. A randomization check was done by use of the Chi-square test. This test checked the distributions of males and females over the four different groups. The Pearson Chi-Square was 5.675. With 3 degrees of freedom, the Chi-square was below the critical value of 7.815 so the null hypothesis that there is an equal distribution between males and females between the groups was not rejected.

Questionnaire

Before the survey started, some general information about the research and the survey was explained. The aim and the content of the research were explained first. Then some information about food additives was given. Lastly the respondents were assured full anonymity and confidentially treated answers. After this, a 'page break' was added. This means that you go to the next page of the survey and you can't see the previous question anymore. After every question a page break was added, to make sure the respondents were not distracted by other questions, texts or pictures during the survey. Then the first general information question was asked; 'What is your gender?' this question was answered with either M or F (male/female). After a page break, the question 'What is your age?' was asked. Respondents had to fill in their age typing a number on a blank spot. The demographic information from this question can be analyzed and compared. These two simple questions were asked in the beginning of the survey to give respondents a slow start and to not go into the more difficult questions immediately. After a page break, some information about how to answer the rest of the questions was given. Then, after another page break, the statement '*When buying a food product, I pay attention to additives'* was given. Respondents were asked to evaluate the statement on a 7-point scale from 'strongly disagree' to 'strongly agree'. Knowing if the respondents pay attention to additives when buying food products gives information about the respondents' involvement on the subject. Another page break was added.

Acceptance and naturalness

The following statements were formulated to measure the respondents' perceived naturalness of the additive and the acceptance of products containing certain additives. To gain insight in consumers' importance for natural additives, the first statement was '*The naturalness of a food additive is important to me'.* Respondents we asked to evaluate the statement on a 7-point scale from 'strongly disagree' to 'strongly agree'. After another page break, the main question about consumer acceptance was stated: '*I would accept a food product more if the additives it contains seem natural to me'.* Because acceptance in this study is about a product containing an additive and not the additive itself, the acceptance of the entire food product was asked. Again, the respondents had to answer on a 7-point Likert scale from 'strongly disagree' to 'strongly agree'. Another page break was added. The past three self-made statements were asked before the experimental question, in order to make the subject more salient on the minds of the respondents. This way, more significant differences between the classes were expected. This is important because no classification study on this subject has been done before. Then the randomization began. The respondents were shown one of the four pictures of a self-made food label of a jar of mayonnaise, based on pictures that can be

found in the Appendix. The words 'sorbic acid' and 'natural flavors' were removed, because they might have influenced the results. Also, the background of the picture was made white instead of green because the color might have influenced the results too. The used pictures are shown earlier in the method section. With the following question, the perceived naturalness of the four classes of food additives was measured. Below the picture, on the same page, the question: '*How natural is the **BOLD** food additive on the picture?*' was asked. This question was copied from Rozin (2005). The reason that **BOLD** was in the question, is because the relevant additive on the food label was typed in bold and capital letters, to show the respondents which additive they should assess. The respondents were asked to answer on a 7-point scale from 'Not natural at all' to 'Completely natural'. A page break was added.

Attitudes

In order to get a complete view of the respondents' attitudes towards food products containing certain additives, the three components of attitudes needed to be measured. These are affective, behavioural and cognitive (ABC). For this reason, three statements were asked to evaluate. The first two questions were taken from Ajzen's Sample TPB Questionnaire (2002). The first statement was '*For me, the food product described on the label would be..'* with a 7-point scale from 'extremely valuable' tot 'extremely worthless' (Ajzen, 2002). The picture of the same food label as showed to the respondent before was shown above the statement. The cognitive part of the attitude was measured with this statement. A page break was added. To measure the affective part, the statement '*For me, eating food products with natural additives is..'* (Ajzen, 2002*)* was asked to be evaluated on a 7-point scale from 'extremely pleasant' to 'extremely unpleasant'. Another page break was added. The final statement was '*When buying food products, I take the naturalness of the additives it contains into account'.* Again, respondents had to answer on a 7-point scale from 'strongly agree' to 'strongly disagree'. The Cronbach's Alpha of the three questions about attitude combined, was only .310, which means that the reliability is very low (.310<.7). The 'Cronbach's Alpha if item deleted' would have gone up to a maximum of .350 if the results of the affective question were deleted. Because of the low Cronbach's Alpha, the three items cannot be taken into one variable. For this reason, further analyses will be done separately for each of the attitude questions.

Buying intention

After another page break, the final statements about buying intention were given. The statement, was copied from Ajzen's sample TPB questionnaire was '*I intend to buy food products containing additives that seem natural to me'* (Ajzen, 2002). Respondents had to answer on a 7-point scale from 'strongly agree' to 'strongly disagree'. After a page break, the same picture as in the question about perceived naturalness was shown, but this time with the statement '*I would buy a food product when it contains the **BOLD** food additive on the picture'*. This question gives insight in consumers' buying intention of products containing the same additive that they assessed before. Respondents were asked to answer on a 7-point scale from 'strongly agree' to 'strongly disagree'. Another page break was added before the final statement; '*I would still buy a food product when the additives that it contains seem unnatural to me'.* Respondents were asked to answer on a 7-point scale from 'strongly agree' to 'strongly disagree'.

Analysis

For the result analysis, SPSS was used. Hypotheses 1 to 4 were tested with an ANOVA. The ANOVA compared the perceived naturalness of the four groups of additives. First the differences between the groups 1 and 2, 2 and 3 and 3 and 4 were measured. Then an overarching analyses was executed to see if the groups were indeed decreasing in naturalness. For hypothesis 5, a linear regression was run to see whether there was a predictive link between the independent variable 'Perceived Naturalness' and the dependent variable 'Attitude towards product'. These hypotheses combined answer the research question '*To what extent do consumers perceive food additives as natural when they are communicated in different ways, and how does this affect the consumer's attitude towards the product containing these additives?'*. Buying intention was also measured using independent t-tests.

Results

In the table 1 are the means and standard deviations of the perceived naturalness of the additives and the attitudes towards the product, of the four different classes of additives. The characters *a* and *b* stand for the groups of classes which do not significantly differ from each other.

Table 1: Mean Perceived Naturalness and Average Attitude per class

	$M_{naturalness}$	$SD_{naturalness}$	$M_{attitude}$	$SD_{attitude}$
1 Lemon juice	5.280*a*	1.595	4.053*ab*	0.785
2 Citric acid extracted from real lemons	4.545*a*	1.625	4.349*a*	0.701
3 Citric acid	4.391*a*	1.672	4.101*ab*	1.047
4 E330	3.400*b*	1.607	3.707*b*	0.676

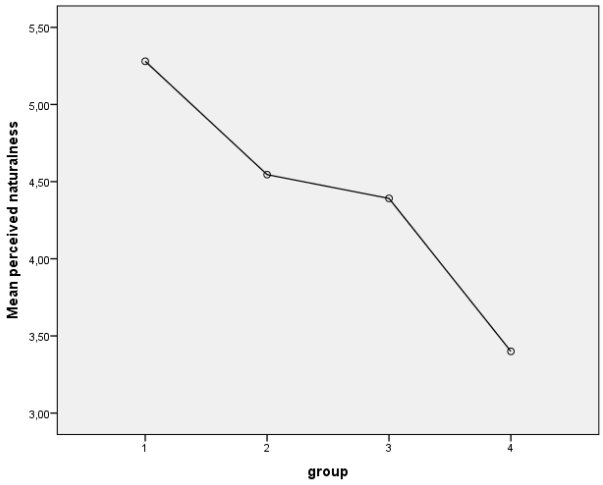
a=group 1, b=group 2

Table 2 shows the three components of attitude taken separately, because the Cronbach's Alpha of three questions about attitude combined was too low. Att1 stands for the cognitive part of the attitude, att2 for the affective part and att3 for the behavioural part.

Table 2: Attitudes per class

	M_{att1}	SD_{att1}	M_{att2}	SD_{att2}	M_{att3}	SD_{att3}
1 Lemon juice	4.120	1.269	4.480	0.823	3.560	1.474
2 Citric acid extracted from real lemons	4.091	0.971	4.864	0.990	4.091	1.477
3 Citric acid	4.124	1.230	4.391	0.891	3.739	2.072
4 E330	3.520	1.194	4.200	0.707	3.400	1.607

Figure 4: perceived naturalness per class



The fourth hypothesis overarches the first three hypotheses and examines if the four classes of additives are indeed descending in perceived naturalness. The hypothesis reads; '*The four classes of communicating the same additive, are descending in perceived naturalness, from: 'the natural product' to 'an extract of a natural product' to 'a lab-made version identical to the natural product' to 'the E-number of the additive'.* Levene's test (Levene's Statistic=.065, p=.978) shows that the variances of the different groups do not differ significantly. A One-Way ANOVA was carried out between the four classes of additives. The results are $F(3 , 91)=5.666$, $p<0.01$. This means that the four different classes of additives indeed differ in perceived naturalness in some way. A pairwise comparison is carried out by the likes of LSD, to investigate the different combinations between classes. This Post-Hoc test showed that only class 4 (E330) significantly differs from all of the other 3 classes. As visible from

figure 4, class 1, 2 and 3 are also descending in mean naturalness, but they do not significantly differ from each other.

For the first hypothesis, the difference in means between the first two classes 'natural product' (M=5,280, SD=1,595) and 'extract of a natural product' (M=4,545, SD=1,625) is calculated. Levene's test showed (Levene's Statistic=.118, p=.733) that the variances of the groups do not differ significantly. The results of the One-Way ANOVA are F(1 , 45)=2,439, p=.125. No significant difference between these classes is measured, which means that hypothesis 1 is rejected. The Post-Hoc analysis of the overall One-Way ANOVA showed Mean Difference=0.735 with Std. Error=0.475.

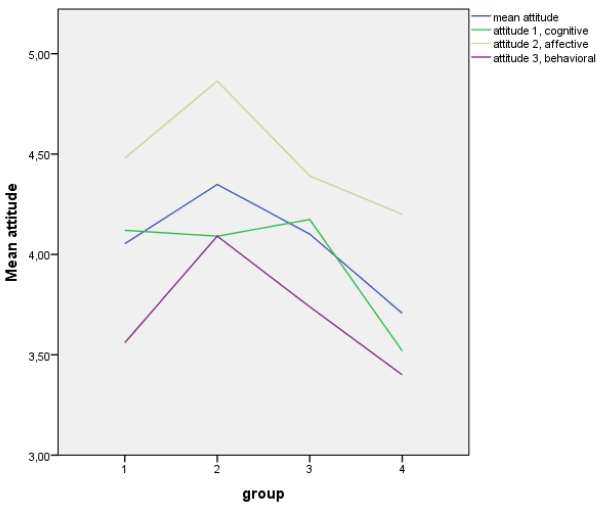
The second hypothesis that is tested is about the difference in mean perceived naturalness between class 2 'extract of a natural product' (M=4,545, SD=1,625) and class 3 'lab-made version identical to the natural product' (M=4,545, SD=1,625). Levene's test showed to be insignificant (Levene's Statistic=.118, p=.733). The ANOVA showed F(1 , 43)=0.098, p=.755. This means that there is no significant difference between these two classes, so hypothesis 2 is rejected. The Post-Hoc analysis of the overall One-Way ANOVA showed Mean Difference=0.154 with Std. Error=0.484.

The third hypothesis is about the difference in perceived naturalness of class 3 'lab-made version identical to the natural product' (M=4.391, SD=1.672) and class 4 'the E-number of the additive' (M=3.400, SD=1.607). Levene's test once again showed to be insignificant (Levene's Statistic=.068, p=.796). Like the previous two hypotheses, a One-Way ANOVA is carried out, resulting in F(1 , 46)=4.385, p=0.42. This shows a significant difference between the means of these two classes. The hypothesis is accepted. The Post-Hoc analysis of the overall One-Way ANOVA showed a significant Mean Difference=0.991 with Std. Error=0.469.

The fifth and final hypothesis reads; '*Higher perceived naturalness of food additives leads to a more positive attitude towards the food product containing the additives'.* This hypothesis will be tested with a linear regression analysis. Because the Cronbach's Alpha of three questions about attitude combined was too low, each of the three questions is taken separately. For the first calculation, the independent variable is the perceived naturalness of the additives and the dependent variable is the cognitive part of the attitude. The results of the regression analysis are F(1 , 93)=16.335, p<.01. Furthermore, R=.387, R_{square}=.149, B=0.264 with a std. error of 0.065. These results mean a higher the perceived naturalness of additives significantly leads to a more positive cognitive part of the attitude towards the food product containing the additives.

The second part of the attitude that is measured is the affective side. Again, the independent variable is the perceived naturalness of the additives, the dependent variable is the behavioural part of the attitude towards the product. The results of the regression analysis are F(1 , 93)=0.114, p=.736, R=.035, R_{square}=.001. This means that there is no significant relationship between perceived naturalness of the additive and the affective side of the attitude towards the product.

Figure 5: Attitudes per class



The third and final part of the measured attitude is the behavioural part. The independent variable is the perceived naturalness of the additives and the dependent variable is the cognitive part of the attitude. The results of the regression analysis are F(1 , 93)=2.854, p=0.095. Furthermore, R=.173, R_{square}=.030. This behavioural part of the attitude towards the product containing the additive shows no significant result with perceived naturalness of the additive. Figure 5 shows the mean

attitudes per different class and the overall mean attitude (blue).

The first of the three questions about buying intention is '*I intend to buy food products containing additives that seem natural to me'*. The results of an independent T-test are M=3.768, SD=1.621, p<.01. A score of 3.768 on a 7-point scale shows a slight tendency to the 'strongly disagree' side, but it is very close to the middle. That would mean that people do not really take the additives of products they buy into account. The second question was about buying intention of a product if it contains the additive displayed on the picture. There were four different pictures, one per class. For this reason, an ANOVA was carried out. Class 1 'the natural product' has M=4.840, SD=1.573. Class 2 'an extract of a natural product' has M=4.636, SD=1.255. Class 3 'a lab-made version identical to the natural product' has M=5.087, SD=1.379, and class 4 'the E-number of the additive' has M=5.160, SD=1.700. None of these means significantly differ from each other. From this it can be concluded that when it comes to actual buying intention, people do not bring the different classes of used additives into decision. The final question addressed buying intention in relation to unnatural additives in general. Respondents were asked on a 7-point scale if they would still buy a food product when the additives that it contains seem unnatural to them. The results are M=4.737, SD=1.446, p<.01. This means that people, although not far from the mean, will still buy their product if the additives it contains are unnatural to them.

Discussion

The number of additives used in food products has been increasing in the last decades. Consumers are getting more aware and concerned about this, they prefer 'pure' and natural food (Paans, 2013), and the natural is generally preferred over synthetic (Devcich et al. 2007). Also higher perceived naturalness leads to more buying intention (Devcich et al. 2007), which is caused by attitude. These statements together with other existing literature leads to the following research question; '*To what extent do consumers perceive food additives as natural when they are communicated in different ways, and how does this affect the consumer's attitude towards the product containing these additives?*'.

Four classes of additives are set up to realize 'different ways of communicating'. These classes are 'the natural product' to 'an extract of a natural product' to 'a lab-made version identical to the natural product' to 'the E-number of the additive'. Several hypotheses are formulated, in order to fully answer to the research question.

The first four hypotheses concern to what extent consumers perceive food additives as natural. The means of the four classes of additives are descending in naturalness. However, the first three classes do not significantly differ from each other. Only the fourth class 'E-number of the additive' significantly differs from the other three classes. This means that the consumer only perceives an additive as less natural compared to the other classes when it is communicated with an E-number. There is still very little knowledge about E-numbers and they cannot be correctly recognized by consumers (Tarnavölgyi, 2003). This might have influence on the lower perceived naturalness of the E-number.

The fifth and final hypothesis concerns the influence of perceived naturalness of additives to the attitude of the product containing these additives. According to the ABC-model, formed attitude consists of an affective, a behavioural and a cognitive side. These three sides are measured separately. Regression analyses shows a strong influence of perceived naturalness on the cognitive part of the attitude. There is no significant result of the regression analysis on the affective or the behavioural part of the attitude. The three levels of measured attitude would have been taken into one variable, however, this cannot be done because of a low Cronbach's Alpha. The reason for this low Cronbach's Alpha is unknown. It makes the results on formed attitude towards the product limited. In future research, more than one question on each aspect of the ABC-model can be involved in the survey to make it more reliable.

Existing literature implies a relationship between perceived naturalness and buying intention. However, in this research consumers do not take the type of used additives into account when buying food products. The results on this might be limited because the example product used in the questionnaire is a jar of mayonnaise. Mayonnaise is typically an industrially made product. More significant results are expected when a more natural product is used. This research made use of the theory of planned behaviour to predict buying intention. According to Paans (2013) intention to avoid E-numbers is higher than the actual avoidance of E-numbers. In future research, buying behaviour can be measured instead of buying intention. This can be done with a virtual supermarket or a real life experiment. Behaviour might differ from intention and this way also the behaviour for different kinds of food products can be measured. Instead of a jar of mayonnaise, more natural products can be used. Even the difference in buying behaviour between natural and industrial products can be measured.

This study is relatively new in the way of the division of additives in classes. The study's broad goal is to find out differences between the classes and influences on attitude. The study cannot yet focus on

possible differences regarding gender and age per class, due to a lack of time. However, the age distribution of all respondents in this study is not representative. The low average age of 24 is due to the survey being spread on social media. Future research can go deeper into age and gender differences. An effect on either gender or age can be interesting for companies with a specific target group. If a significant difference between the 'natural' classes and the 'artificial' class was found, it might have been worth it for companies to change their ways of production. However, this is not the case so no more future research on this topic is needed.

There is no significant relationship between the attitude towards the product and the buying intention of this product. This means that it cannot be said that changing the way of communicating the additive will improve a companies' sales. However, a more positive attitude towards a companies' product is always desirable. The results of this research imply that for companies in order to acquire a more positive attitude towards their products, the use of E-numbers should be avoided.

References

Ajzen, I., (1991). "The theory of planned behavior". Organizational Behavior and Human Decision Processes. 50 (2): 179–211.

Ajzen, I., (2002). *Sample TpB questionnaire*. from the website: http://www-unix.oit.umass.edu/~aizen/pdf/tpb.questionnaire.pdf

Ajzen, I., & Fishbein, M. (2008). Scaling and testing multiplicative combinations in the expectancy–value model of attitudes. *Journal of Applied Social Psychology*, *38*(9), 2222-2247.

Bearth, A., Cousin, M. E., & Siegrist, M. (2014). The consumer's perception of artificial food additives: Influences on acceptance, risk and benefit perceptions. Food Quality and Preference, 38, 14-23.

Brockman, C., Beering, C.J.M. (2011). Consumer Perceptions of Additives in Dairy Products. Elsevier Ltd. (2011)

Cardello, A. V., & Sawyer, F. M. (1992). Effects of disconfirmed consumer expectations on food acceptability. Journal of Sensory Studies, 7(4), 253-277.

Connor, M., & Siegrist, M. (2010). Factors influencing people's acceptance of gene technology: The role of knowledge, health expectations, naturalness, and social trust. Science communication, 32(4), 514-538.

Dangol, R., Islam, M. S., Hyvärinen, M., Bhusal, P., Puolakka, M., & Halonen, L. (2013). User acceptance studies for LED office lighting: Preference, naturalness and colourfulness. Lighting Research and Technology, 1477153513514424.

Devcich, D. A., Pedersen, I. K., & Petrie, K. J. (2007). You eat what you are: Modern health worries and the acceptance of natural and synthetic additives in functional foods. Appetite, 48(3), 333-337.

Evans, G., de Challemaison, B., & Cox, D. N. (2010). Consumers' ratings of the natural and unnatural qualities of foods. Appetite, 54, 557-563.

Fandos, C., & Flavián, C. (2006). Intrinsic and extrinsic quality attributes, loyalty and buying intention: an analysis for a PDO product. British food journal, 108(8), 646-662.

Hauser, M., Jonas, K., Riemann, R. (2011). Measuring salient food attitudes and food-related values. An elaborated, conflicting and interdependent system. Appetite 57 (2011) 329 – 338

Kaplan, R., & Talbot, J. F. (1988). Ethnicity and preference for natural settings: A review and recent findings. Landscape and Urban Planning, 15(1), 107-117.

King, S. C., Weber, A. J., Meiselman, H. L., & Lv, N. (2004). The effect of meal situation, social interaction, physical environment and choice on food acceptability. Food quality and preference, 15(7), 645-653.

Knowles, T., Moody, R., & McEachern, M. G. (2007). European food scares and their impact on EU food policy. British food journal, 109(1), 43-67.

Li, M., & Chapman, G. B. (2012). Why do people like natural? Instrumental and ideational bases for the naturalness preference. Journal of Applied Social Psychology, 42(12), 2859-2878.

Machado, A. (2004). An index of naturalness. Journal for nature conservation, 12(2), 95-110.

Paans, E. (2013). Investigating consumers' avoidance of E-numbers. (MSc), Wageningen University, Wageningen.

Rozin, P. (2005). The meaning of “natural”, Process more important than content. Psychological science, 16(8), 652-658.

Rozin, P., Spranca, M., Krieger, Z., Neuhaus, R., Surillo, D., Swerdlin, A., & Wood, K. (2004). Preference for natural: instrumental and ideational/moral motivations, and the contrast between foods and medicines. Appetite, 43(2), 147-154.

Shim, S. M., Seo, S. H., Lee, Y., Moon, G. I., Kim, M. S., & Park, J. H. (2011). Consumers’ knowledge and safety perceptions of food additives: Evaluation on the effectiveness of transmitting information on preservatives. Food Control, 22(7), 1054-1060.

Siegrist, M. (2008). Factors influencing public acceptance of innovative food technologies and products. Trends in Food Science & Technology, 19(11), 603-608.

Sterk & Tuenter, (2016). Honig doet E-nummers in de ban https://www.nrc.nl/nieuws/2016/10/10/honig-doet-e-nummers-in-de-ban-4764713-a1525906

Strik BV, (2012). Van natuur identiek naar natuurlijk http://www.strik.eu/Consudel%20Prova.pdf

Tarnavölgyi, G. (2003). Analysis of consumers attitudes towards food additives using focus group survey. Agriculturae Conspectus Scientificus (ACS), 68(3), 193-196.

Tenbült, P., de Vries, N. K., Dreezens, E., & Martijn, C. (2005). Perceived naturalness and acceptance of genetically modified food. Appetite, 45(1), 47-50.

Tingchi Liu, M., Brock, J. L., Cheng Shi, G., Chu, R., & Tseng, T. H. (2013). Perceived benefits, perceived risk, and trust: Influences on consumers' group buying behaviour. Asia Pacific Journal of Marketing and Logistics, 25(2), 225-248.

Van Loon, NRC, (2014). E-nummers zijn per definitie onschadelijke stoffen. https://www.nrc.nl/nieuws/2014/11/29/e-nummers-zijn-per-definitie-onschadelijke-stoffe-1441404-a1035244

Voedingscentrum, (2016). EFSA. http://www.voedingscentrum.nl/encyclopedie/efsa.aspx

Appendix

1 Survey

Thank you in advance for participating in this research about food additives. A food additive is a substance added to a food product for reasons like enhancing taste and preservability. These additives can be communicated in different ways, for example with an E-number. You will get a couple of questions about the naturalness of food additives and your attitude towards a food product. All your answers stay anonymous and will be treated confidentially. Good luck!

What is you gender?

male/female

What is your age?

[ ]

Please answer each of the following questions by clicking the number that best describes your opinion. Some of the questions may appear to be similar, but they do address somewhat different issues. Please read each question carefully.

When buying a food product, I pay attention to additives.

strongly disagree :___1__:___2__:___3__:___4__:___5__:___6__:___7__: strongly agree

Naturalness and acceptance

The naturalness of a food additive is important to me.

strongly disagree :___1__:___2__:___3__:___4__:___5__:___6__:___7__: strongly agree

I accept a food product more if the additives it contains seem natural to me.

strongly disagree :___1__:___2__:___3__:___4__:___5__:___6__:___7__: strongly agree

INGREDIENTS: water, oils (soybean oil, extra virgin oil), vinegar, whole eggs and egg yolks, modified corn starch, sugar, salt, **LEMON JUICE**, calcium disodium, raspberry flavors, perservative, paprika, beta-catotene (color)

Here you see a possible food label of a jar of mayonnaise.

*How natural is the **BOLD** food additive on the picture?*

not natural at all :___1__:___2__:___3__:___4__:___5__:___6__:___7__: completely natural

Attitude

For me, the food product described on the label above would be

extremely valuable :___1__:___2__:___3__:___4__:___5__:___6__:___7__: extremely worthless

For me, consuming food products with natural additives is

extremely pleasant :___1__:___2__:___3__:___4__:___5__:___6__:___7__: extremely unpleasant

When buying food products, I take the naturalness of the additives it contains into account.

strongly agree :___1__:___2__:___3__:___4__:___5__:___6__:___7__: strongly disagree

Buying intention

I intend to buy food products containing additives that seem natural to me.

strongly agree :___1__:___2__:___3__:___4__:___5__:___6__:___7__: strongly disagree

*I would buy a food product when it contains the **BOLD** food additive on the picture.*

strongly agree :___1__:___2__:___3__:___4__:___5__:___6__:___7__: strongly disagree

I would still buy a food product when the additives that it contains seem unnatural to me.

strongly agree :___1__:___2__:___3__:___4__:___5__:___6__:___7__: strongly disagree

Thank you very much for completing this questionnaire.

If you have any comments or suggestions, you can leave them here.

I_____I

2 – Inspirations for survey label