Comparing clean labels versus labels including E-numbers from a consumer perspective

Do consumers prefer clean labels, or labels which include E-numbers on their label, as it is currently regulated by the food law in Regulation (EC) No. 1333/2008 on food additives?

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Preface

I proudly present my master thesis in which I investigated the preference of consumers for clean labels or E-number including labels. This thesis was written for my studies Food Safety at Wageningen University and Research. I have worked on this thesis with great pleasure during the past half year. I started to write this thesis because of the negative attitude of consumers towards E-numbers and my desire to find out if consumers are preferring clean labels over E-number including labels. Therefore, this thesis can be used to answer this question and to improve Regulation (EC) 1333/2008 on food additives, by taking into account the consumers interests and preferences which are set out in this thesis.

I would like to thank Kai Purnhagen for his help as a supervisor. I would also like to thank my friends and family for helping and supporting me. Besides, I would like to thank all the respondents for their time, commitment, and contribution by filling in the questionnaire.

Enjoy your reading.

Alida Meijer,
Wageningen, January 2020.

Abstract

Previous studies have shown that consumers do not trust E-numbers. As a consequence, a new trend of clean labelling is arising. The purpose of this thesis is to investigate if consumers prefer clean labels over E-number including labels. This could be used to improve Regulation 1333/2008 by including the consumers interests like shown in this study. Literature research and a questionnaire is used to answer this question. The results of the questionnaire reveal that consumers know what food additives and E-numbers are. Despite this knowledge, most respondents indicated to prefer an ingredient list in a clean label format. This could be explained by the finding that the respondents see E-numbers as unclear and difficult to understand. In addition, respondents indicated that they find it important that food labels are easy to read and indicated that E-number are not easy to read. The results of this study leads to the assumption that it is not in the interest of the consumer to make use of E-numbers on food labels. These results imply that it would be in the interest of the consumer to change the system of E-numbers by amending Regulation (EC) No. 1333/2008 on food additives and taking the view and interests of the majority of consumers into account. When using this study it should be considered that the questionnaire of this study does not reflect the average European citizen and more research is needed to confirm the results of this study.

Keywords: consumers view, food additives, clean labels.

Summary

Aim: Regulation (EC) No. 1333/2008 on food additives aims to protect the human health and the consumer interests. Previous studies already indicated that consumers have a negative attitude towards E-numbers. As a result, a new trend of clean labelling is arising. There are no previous studies which investigated if consumers prefer this new way of labelling over the current system of using E-numbers. Therefore, this thesis aims to investigate if consumers prefer clean labels over labels which do include the E-numbers. The finding of this study could be used to amend Regulation (EC) No. 1333/2008 on food additives and include the interest of the majority of consumers.

Method: In this thesis a literature study and questionnaire is carried out to answer the question: *Do consumers prefer clean labels, or labels which include E-numbers on their label, as it is currently regulated by the food law in Regulation (EC) No. 1333/2008 on food additives?*. In the literature study information is analyses regarding the relevant legislation and the current literature regarding E-numbers and clean labels. The questionnaire is distributed through the course Food Law at the Wageningen University and social media like Facebook, LinkedIn, and WhatsApp groups. This questionnaire consists of a combination of drop-down, multiple choice, Likert scale, and open-ended questions. In this questionnaire questions are asked about the respondent's knowledge, and preference for attributes of food labels like safety, healthiness, naturalness, readability, and familiarity. The respondents had to choose between four different labels representing ingredient lists in different forms using E-numbers, chemical names, combination of E-numbers and chemical names, and clean label ingredient lists. The questionnaire is distributed in Dutch and English to address as many nationalities as possible.

Results: The questionnaire recorded 212 responses of which 167 responses are included and analysed in this study. The remaining 45 respondents were excluded because of not completing the questionnaire or because they did not live in the European union. The results of the questionnaire show that consumers find safety the most important attribute of a food product. Even though the results of the questionnaire reveals that E-numbers are not seen as unsafe or safe, most of the respondents preferred the ingredient list with the clean label format. The most mentioned reason which is indicated for being the reason to prefer this option, is it being the easiest to read option. An easy to read ingredient list is also indicated to be the second most important factor of a food product among the options given in the questionnaire. Besides, E-numbers are seen by most respondents as unclear and difficult to understand, which is in line with the results of previous studies. This explains the fact that most respondents preferred the clean label option over ingredient lists with E-numbers even though this preference is variated.

Conclusion: Regulation (EC) No. 1333/2008 on food additives aims in article 1 to protect the human health and the consumer interests. The majority of citizens should be taken into account when revising Regulation 1339/2008 according to article 4.2 of Regulation (EU) No. 1169/2011 on the provision of food information to consumers. E-numbers are not trusted and are seen as dangerous by consumers. Therefore, it can be concluded that the Regulations aim to protect the interest of the consumer is not reached at this moment. On the other hand the questionnaire showed that most people knew what E-numbers and food additives are, which is not in line with the result of the literature study. Most respondents of the questionnaire did not know what clean labels are, but mostly they were seen as products which only consists out of recognizable ingredients. When comparing how E-numbers are perceived in correlation to clean labels, it is concluded that clean labels are perceived as the most

natural, healthiest, safest, easiest to read, and most recognizable ingredient list. In addition, the respondents indicated that they preferred the clean label option more often, compared to the other options.

Discussion and recommendations: The results of this study might not give a good reflection of the general resident of the European Union. This is due to the fact that not an equal amount of respondents are included with the same age, education level, and the country in which they live which is comparable with the average European citizen. Besides, many of the respondents of this study were having a background for which they knew what E-numbers are. Therefore, this study should be carried out again among a more average group of respondents comparable to the average European citizen. This study can be used to take into account the view of the consumer regarding food additives to amend Regulation (EC) No. 1333/2008 on food additives like is aimed in article 9 of Regulation (EC) No. 178/2002 on general principles and requirements of food law. According to article 4 (2) of Regulation (EU) No. 1169/2011 on the provision of food information the majority of consumers should be taken into account when looking at the consumers interest to evaluate and revising Regulation (EC) No. 1333/2008 on food additives. The result of this study show that a majority of the respondents preferred clean labels over E-number including labels and E-numbers are seen as unclear and difficult to understand. Therefore, the European union is advised to take the consumers interest of the majority into account and implement a new or improved system of indicating food additives and guaranty the safety of the consumer in a way in which the consumers would prefer to receive food information. When using this study it should be considered that the questionnaire of this study does not reflect the average European citizen and more research is needed to confirm the results of this study.

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List of abbreviations

EFSA: European food safety authority
ADI: Acceptable daily intake
EU: European Union
SPSS: Statistical package for the social sciences
SCF: Scientific Committee for Food
Regulation 1333/2008: Regulation (EC) No. 1333/2008 on food additives

1. Introduction

1.1 Background

Article 8 of Regulation (EC) No. 178/2002 on general principles and requirements of food law stated that (1) the law aims to protect the consumers interests. Besides the law aims to provide a basis for consumers to make informed choices. Public consultation should be considered when preparing, evaluating or, revising food law (Art 9. Regulation (EC) No. 178/2002 on general principles and requirements of food law). The majority of consumers should be taken into account when looking at their interests (Art 4. Regulation (EU) No. 1169/2011 on the provision of food information to consumers). For food additives this is regulated by Regulation (EC) No. 1333/2008. In article 1 of this Regulation it becomes clear that this Regulation intents to protect the interests of consumers and stimulate fair practices for companies. The definition of a food additive is described in article 3 (2a) of this Regulation. It states that *''a food additive shall mean any substance not normally consumed as a food in itself and not normally used as a characteristic ingredient of food'' (P. 20)*. Article 3 (2a) states that *''a food additive can be used for technological purpose in the manufacture, processing, preparation, treatment, packaging, transport or storage'' (P.20)*. Food companies have to indicate the name and E-number or its sales description of the additives on the product label (Art. 22 (1a) and Art. 23 (1a) Regulation (EC) No. 1333/2008 on food additives).

An E-number indicates that the additive is scientifically tested and proved to be safe by the EFSA (European Food Safety Authority). In order to decide if an additive is safe to consume the EFSA establishes an acceptable daily intake (ADI) of each substance (EFSA, Food additives). The ADI is the amount of the substance that a consumer could safely consume on a daily basis without any adverse health effects (Voedingscentrum, Aanvaardbare dagelijkse inname (ADI)). Besides, using the ADI to determine if an additive is safe, the EFSA could also use a margin of safety and when it is already indicated to be safe an ADI is not needed at all. For example, this could be the case for components which are already present in the body or if it is a component which is regularly consumed in the current diet without any adverse health effects. Indicating that an additive is safe could also be done with animal studies which have shown that there are no adverse health effects (EFSA, Food additives).

Because of a negative attitude of consumers towards E-number a new trend of clean labelling is arising (Haen, 2014; Arbindra et al., 2001; Shim et al., 2011). At this moment no official legal definition exists for clean labels. Consequently, at this moment the definition of clean labels is subjective and depends on the knowledge of the consumer towards ingredients, the production methods, and the conclusions which the consumers drawn from this (Asioli et al., 2017).

1.2 Problem definition

Consumers do not trust E-numbers and they see E-numbers as chemicals which do not belong in our food (Haen, 2014). A survey in the Netherlands in 2010 points out that half of the respondents which participated are occasionally or frequently worried about the safety of food additives (Consumentenbond, 2010). Studies show that consumers worry more about food additives than that they do for microorganisms (Shim et al., 2011). Even though microorganisms are causing spoilage and sickness and food additives can be used to prevent contamination of microorganisms, for example when used as a preservative (Rawat, 2015).

Another explanation for this negative attitude is that consumers are not aware of the meaning, functions, and advantages of food additives (Shim et al., 2011). Some consumers think that food

additives are certain ingredients like salt or sugar. In a study of Varela & Fiszman this is explained by the idea of consumers that food additives are added substances which they associate with claims, or ingredients which could be left out of the product (Varela & Fiszman, 2013).

A consequence of the lack of knowledge of the consumer about the meaning of food additives is that food additives with hard to pronounce names are perceived as more harmful and novel than easy to pronounce ingredients (Song & Schwarz, 2009). Products which contain food additives are also perceived as unhealthier compared to products which contain no or less food additives (Wandel, 1997). Because of this negative attitude towards E-numbers, producers are avoiding E-numbers on their labels and replacing this for products with clean labels. A previous study already showed that consumers prefer a label with chemical names over a label with the E-numbers (Wandel, 1997). From this previous study one could expect that consumers will prefer clean labels over labels which include E-numbers, but no previous studies have been executed to support this statement. Therefore, the goal of this thesis is to find out if consumers prefer clean labels or labels which do indicate the E-numbers on their label. The finding of this study could be used to amend Regulation (EC) No. 1333/2008 on food additives and include the interest of the majority of consumers (Art 9. Regulation (EC) No. 178/2002 on general principles and requirements of food law; Art 4. Regulation (EU) No. 1169/2011 on the provision of food information to consumers).

1.3 Research question

The following research question will be answered:

Do consumers prefer clean labels, or labels which include E-numbers on their label, as it is currently regulated by the food law in Regulation (EC) No. 1333/2008 on food additives?

The research question is divided in the following sub questions:
- *What is the aim of Regulation (EC) No. 1333/2008 on food additives?*
- *How are the consumers interests towards food additives regulated by law?*
- *What is already known about the knowledge and the view of consumers regarding E-numbers?*
- *What is already known about the knowledge and the view of consumers regarding clean labels?*
- *How do consumers perceive clean labels compared to labels including E-numbers?*

1.4 Outline

In order to answer the research question a desk and field research is executed in which a literature study and a questionnaire is carried out. In chapter 2 the methods for this thesis are explained. In chapter 3 the legislation on food additives will be examined. In chapter 4 the consumers knowledge regarding food labels will be described. In chapter 5 it will be described how consumers perceive food additives. In chapter 6 information about the knowledge and the attitude of consumers towards E-numbers is provided. In chapter 7 the consumer's knowledge on clean labels and the consumer's attitude towards those labels is provided. In chapter 8 the results of the questionnaire which was distributed are given and will be analysed. In chapter 9 a conclusion is given. In chapter 10 the discussion is set out and some recommendations are given. Chapter 11 will give an overview of the literature which is used for this thesis.

2. Methods

2.1 Research design

In order to answer the question: *Do consumers prefer clean labels, or labels which include E-numbers on their label, as it currently is regulated by the food law in Regulation (EC) No. 1333/2008 on food additives?* a quantitative research is performed. A literature study is carried out and a questionnaire is distributed.

2.2 Collection of data

To find out how food additives are regulated and why this is regulated, a literature review is executed for the legislation of food additives. To find out what is already known about the knowledge and views of consumers towards clean labelling and E-numbers a literature review is executed. For the literature review information will be gathered from the following database: Google Scholar, PubMed, HeinOnline, WUR Library, and EUR-Lex. To search for relevant articles the following search terms are used in the databases: 'Regulation 1333/2008', 'E-numbers', Clean labelling', 'Food additives', 'Influence E-numbers', 'Influence Clean labelling', 'Consumer perception towards E-numbers', 'Consumer perception towards clean labels', 'Consumers perception food additives'.

Based on the information of the literature review a questionnaire (Appendix 1&2) is composed which is distributed to consumers. Information will be gathered from all European citizens, the questionnaire will be distributed in English and in Dutch. This questionnaire will be distributed in the Netherlands and therefore there will be a Dutch questionnaire (Appendix 1) to address all Dutch speaking people. There is an English version of the questionnaire (Appendix 2) to address people of other nationalities. This questionnaire will be distributed through the course Food law at the Wageningen University and social media like Facebook, LinkedIn, and WhatsApp groups. This questionnaire will consist of a combination of drop-down, multiple choice, Likert scale, and open-ended questions. In this questionnaire questions are asked about the respondent's knowledge, and preference for attributes of food labels like safety, healthiness, naturalness, readability, and familiarity. The respondents had to choose between four different labels representing ingredient lists in different forms using E-numbers, chemical names, combination of E-numbers and chemical names, and clean label ingredient lists.

2.3 Inclusion criteria

The literature review is based on English and Dutch articles which focus on Regulation (EC) No. 1333/2008 on food additives (Regulation 1333/2008), clean labelling, E-numbers, food additives, the consumers perception towards clean labels, the consumers perception towards E-numbers, and food additives.

The data of the questionnaire only includes completely filled in questionnaires of respondents living in the European Union (EU), as the answers need to be comparable with each other and this thesis is focusing on EU legislation.

2.4 Exclusion criteria

The literature review excludes articles in other languages than English and Dutch. Furthermore, articles about additives in animal feed product, additives in non-food products, additives which are not meant for the end-consumer, and alternatives for E-numbers will not be included in this review. The data of the questionnaire excludes questionnaires which are not filled in completely, because the results of the questions can't be compared with each other. Respondents who do not live in the EU are excluded, because this thesis is focusing on EU legislation.

2.5 Data analyses

To create and distribute the questionnaire the program Qualtrics is used. This program makes it possible to ask all types of questions and distribute this questionnaire trough social media and during the course Food Law at the Wageningen University. The data is gathered in numbers and words, which will be analysed in SPSS (statistical package for the social sciences). The results of the Likert scale questions are compared with each other by Friedman's two-way analysis. These Likert scale questions had a scale of 1 till 5 in which 1=not important and 5=very important. Furthermore, crosstabs are used to compare the results of different questions with each other. Frequencies are used to count the answers of the questions.

3. Legislation on food additives

In this chapter the way in which the consumers interests towards food additives are regulated by law are examined and the aim of Regulation (EC) No. 1333/2008 on food additives will be examined. Sub-chapter 3.1 Background is giving an overview of how Regulation 1333/2008 on food additives came into force by looking at previous laws within the EU and its member states. Sub-chapter 3.2 Laws and interpretation is giving an overview of the laws regarding food additives and its interpretation.

3.1 Background

A special control for food additives was established by Regulation 1333/2008 which came into force on the 20th of January in 2010. This Regulation is directly applicable in all member states of the European Union (European Union. Regulations, Directives, and other acts).

Before this Regulation was established there were already some examples known of current member states with a similar system for food additives before this was established in the EU. Denmark already listed all the food additives which were allowed to use for food colouring. In 1887, Germany adopted the Color Act in which all harmful colours in food were banned. In the past England already adopted some laws for food additives because of food adulteration. This started with a report by Dr. Arthur Hill about the state of English food which showed that copper was used as a colouring agent for fruit and vegetables. Besides, they found that iron was used for colouring of salt and red sauces. This resulted in the Food Adulteration Act in 1860 in England. This act had still a lot of criticism because it was argued that this act only acknowledged food adulteration. Consequently, in 1875 a Food and Drugs Act was passed which states that:

> ''*No person shall mix, colour, stain, or powder any article of food with any ingredient or material, so as to render the article injurious to health, with the intent that the same may be sold in that state, and no person shall sell such article under a penalty not exceeding 50 pound*'' *(p. 396, Burrows, 2009)*.

Together with the amended Food Adulteration Act of 1899 this prevented that any unsafe colouring agent would be used in food manufacturing in England (Burrows, 2009). In the EU there were some earlier Directives that aimed to regulate food additives. In the end this resulted in Regulation (EC) No 1333/2008 on food additives, which came into force in 2010. The first Directive came into force in 1962 which was established for colouring agents and was created out of the desire to establish a single list for food additives. The Directive for colouring agents in 1962 was the start of using the E-number classification system. This Directive for colouring agents was followed by a Directive 65/66/EEC for preservatives, antioxidants 70/357/EEC, and a Directive for emulsifiers, stabilizers, thickeners, and gelling agents 74/329/EEC. It was still up to the members states which products could contain food additives and maximum permitted levels of the food additives (Jukes, 2019). In 1988 a framework Directive 89/107/EEC was set with a list of criteria for food additives by which they are assessed and the maximum levels of the additives was established. This was established to promote a free and fair market of safe food product within the European community. This Directive stated that additives should be assessed by the European Scientific Committee for Food (SCF) (Jukes, 2013). The framework Directive was later amended by Directive 94/34/EC which was based on Directive 94/35/EC on sweeteners in food stuffs, Directive 94/36/EC on colours for use in foodstuffs and Directive 95/2/EC on food additives other than colours and sweeteners (Reinhart, Kraus & Collins, 2010). When the internal market was established in 1993 by the Treaty of Maastricht, full control of food additives was

established by fully harmonizing this throughout the community (Jukes, 2019). Which eventually resulted in Regulation (EC) No 1333/2008 on food additives. The safety of these food additives is guaranteed and controlled by the European Food Safety Authority (EFSA). The EFSA reviews all relevant available scientific data and the human dietary exposure to determine the safety of the food additive on the intended use for human consumption (EFSA, Food additives).

3.2 Laws and interpretation

Article 8 of Regulation (EC) No. 178/2002 on general principles and requirements of food law aims to protect the consumers rights. It is stated that (1) the law aims to protect the consumers interests. Besides the law aims to provide a basis for consumers to make informed choices. Article 9 states that public consultation will be used during preparation, evaluation, and revision of food law. Therefore, Regulation 1333/2008 should take new insight of the consumers interest into account when evaluation and revision takes place.

This aim to protect consumers interest is also repeated in article 1 of Regulation (EC) No 1333/2008 on food additives. Article 1 states that:

> *''this Regulation lays down rules on food additives used in foods with a view to ensuring the effective functioning of the internal market whilst ensuring a high level of protection of human health and a high level of consumer protection, including the protection of consumer interests and fair practices in food trade, taking into account, where appropriate, the protection of the environment'' (P.19, Regulation (EC) No 1333/2008 on food additives).*

From this aim it becomes clear that this Regulation protects the consumer by stating to protect human health and consumer interests. This article lays down rules for food additives which are used in food products. It can be observed that compared to the previous Directives which aimed to set out rules for food additives, Regulation 1333/2008, also aims to protect the environment which is not mentioned before in previous Directives. A second difference is that compared to the previous laws, the current law is a Regulation where the previous laws were Directives. Directives have to be translated to national laws by the member states. This results in differences between the methods used by the member to reach the goals of the Directive. Regulations are directly applicable in all member states (European Union. Regulations, Directives, and other acts). This is a more uniform way to implement the laws in the member states. Therefore, this results in a more effective functioning of the internal market which is also aimed by Regulation 1333/2008.

From article 2 (1) of Regulation 1333/2008 it becomes clear that this Regulation is applicable to food additives because it stated that it applies to food additives. In addition, it also describes which food additives are falling into the scope of this Regulation.

Regulation 1333/2008 provides the following according to article 1(a): A list of approved food additives, 1(b) the conditions of use, and the rules for the labelling of food additives. Before the community list, conditions of use, and rules on the labelling of food additives are given it is important to know which definition is used. This becomes clear from Article 3 (2a) of Regulation 1333/2008.

Article 3 (2a) states that:

> *''food additive' shall mean any substance not normally consumed as a food in itself and not normally used as a characteristic ingredient of food, whether or not it has nutritive value, the intentional addition of which to food for a technological purpose in the manufacture,*

processing, preparation, treatment, packaging, transport or storage of such food results, or maybe reasonably expected to result, in it or its by-product becoming directly or indirectly a component of such foods'' (P.20, Regulation (EC) No 1333/2008 on food additives).

This means that food additives are not the same as regular ingredients and can't be consumed on its own while regular ingredients can. Food additives can be used for technological purpose in the stadiums of manufacturing, processing, preparation, treatment, packaging, transport, or storage.

Not all ingredients used as food additives are regulated by Regulation 1333/2008. An example are food enzymes. They are regulated by Regulation (EC) No 1332/2008 on food enzymes (Art 2 (3), Regulation (EC) No 1333/2008 on food additives). Article 3 (a) of Regulation (EC) No. 1332/2008 on food enzymes gives a definition of a food enzyme. According to Article 3 (a) a *'' 'food enzyme' means a product obtained from plants, animals or micro-organisms or products thereof including a product obtained by a fermentation process using micro-organisms''*. Food enzymes therefore have to follow the rules like set in Regulation (EC) No. 1332/2008 on food enzymes.

When a food additive is falling into the scope in Regulation 1333/2008 they have to follow the rules like set in this Regulation. One of the rules is set in article 4 (1) of Regulation 1333/2008 and states that a food additive could only be used when it is included in the list of Annex II and only under the conditions like specified. Article 4 (2) has specified that only products may be used in food additives, food enzymes, and in food flavourings when they are specified in Annex III. Food additives must also comply to the other rules as set out in this Regulation, otherwise they may not be used (Art. 5, Regulation (EC) No. 1333/2008 on food additives).

For a food additive to be approved they first have to be added on the list of Annex II or Annex III (Art 6 (1), Regulation (EC) No. 1333/2008 on food additives). Article 6 (1) states that additives are approved if: (a) scientific evidence has showed that there is no safety concern to the health of the consumer when the suggested amount is retained, (b) ''*there is a reasonable technological need that cannot be achieved by other economically and technologically practicable means and''* (c) ''*the use does not mislead the consumer'' (P.21, Regulation (EC) No 1333/2008 on food additives)*. Article 6 of Regulation 1333/2008 also states (2) that in order to approve an additive it must have advantages and benefits for the consumer. Such advantages and benefits can be:

(a) ''preserving the nutritional quality of the food'', (b) *''providing necessary ingredients or constituents for consumers with special dietary needs''*, (c) to *''enhance the keeping quality or stability of a food or improving its organoleptic properties''*, (d) ''*aiding in the manufacture, processing, preparation, treatment, packing, transport or storage of food, including food additives, food enzymes and food flavourings*'' *(P.21, Regulation (EC) No 1333/2008 on food additives).*

This article shows that there are many conditions which a food additive has to comply to before they are approved and added to the list of allowed additives. This ensures the safety of the food additives to reach the aim to protect the human health.

In article 11 of Regulation 1333/2008 rules are set to indicate the allowed quantity of food additives in food products. This quantity has to be substantiated by the ADI or equivalent assessment and they have to take into account special groups. In addition, it is only allowed to use the lowest amount

necessary to reach the desired effect (Art 11, Regulation (EC) No. 1333/2008 on food additives). This article is set to protect the safety of the human health.

Food additives are categorized in functional classes, which are set in annex I of Regulation 1333/2008. These functional classes can be used for different purposes according to article 9 (1) which are set in annex II of Regulation 1333/2008. Some food additives need additional information, this is set out in Annex V. Regulation (EU) No. 231/2012, which laid down the specification for food additives that are listed in the Annexes II and III of Regulation 1333/2008.

In article 23 of Regulation 1333/2008 the labelling of food additives intended for the end user are Regulated. It is stated that (1a) the label of a product has to indicate the name and the E-number as given to the food additive in this Regulation. This could get into conflict with article 1 in which is aimed to protect the consumers interests (Regulation (EC) No. 1333/2008 on food additives). It has been found that consumers do not know what E-numbers are (Tarnavölgyi & Molnár, 2004). In addition, consumers do not trust E-numbers and consumers see E-numbers as something dangerous (Wandel, 1997). As a consequence, E-numbers might not protect the interest of the consumer because E-numbers make it difficult for consumers to indicate which ingredients food products contain and consumers could start to avoid E-numbers. This would result in the opposite of what this Regulation tries to achieve, to protect the human health and the interest of the consumer.

Article 4 of Regulation (EU) No. 1169/2011 on the provision of food information to consumers sets out the principles for governing mandatory food information. It states that (1) food information is needed when (a) the information includes the composition, properties, or other characteristics of the food. This applies to food additives because these are part of the composition of the product and could change the properties of the product. Besides, it states (2) that:

> *''When considering the need for mandatory food information and to enable the consumers to make informed choices, account shell be taken of the widespread need on the part of the majority of consumers for certain information to which they attach significant value or of any generally accepted benefits to the consumer''* (P. 26 Regulation (EU) No. 1169/2011 on the provision of food information to consumers*).*

Therefore, the majority of consumers should be taken into account when looking at the consumers interest when evaluating and revising Regulation 1333/2008. At this moment the view of the consumers towards food additives and E-numbers is not mention in Regulation 1333/2008. Still this Regulation should take the consumers view into account to protect the consumers interests like is aimed in article 1 of Regulation 1333/2008 and in Regulation (EC) No. 178/2002 on general principles and requirements of food law.

4. Knowledge of food labels.

To investigate what consumers already know about E-numbers and clean labelling it is important to first look at the knowledge of consumers relating to food labels in general. Therefore, this chapter aims to investigate the knowledge of consumers relating to food labels by looking at the currently existing literature.

A study has established that 79% of the people do read food labels (Wandel, 1997). Another study found that 58% of the respondents read the food labels (Deakin, 2011). A study in India investigated the importance of food information when purchasing a product. They found that the young respondents believed that the information on the product label was from a big importance when purchasing a product. Most of them also answered that they did read the food labels of the products which they purchased (Kumar, & Kapoor, 2017). Even though the percentage of respondents who read the food labels differs in each study, in general all studies found that the majority of people do read the food labels. These studies are executed in different countries and in different years. For this reason, the differences in percentages of respondents reading the food labels could be explained by cultural differences and the different years in which the studies took place. The fact that a majority of the respondents of these studies indicate that they read the food labels could mean that it is important for consumers to have food information. Which means that Regulation (EC) No. 1333/2008 on food additives is right to aim to protect the consumers interest to include information on food additives on the label.

The interest of consumers towards nutritional information can be explained by cultural differences. This has been found by a study which investigated consumers of The Netherlands, The United Kingdom, France, Greece, and Spain. This study found that consumers in The Netherlands and The United Kingdom are more interested in additional nutrition information from food labels compared to France, Greece, and Spain (Grunert, & Wills, 2007).

The interest towards food labels differs between different groups. For instance, a study has found that there does exist a difference between people with a different gender, food habits, and special diets. These factors have an influence on the behaviour of the people towards food labels. For example, it has been found that women and vegetarians are more aware of the food labels and its content (Kumar, & Kapoor, 2017). It also has been found that women do read the food labels more often compared to men, this could be explained by a literature review which showed that women are more interested in nutrition information compared to men (Wandel, 1997; Grunert, & Wills, 2007). Besides, gender, food habits, and special diets, age seems to play a role when looking at the interest towards food labels and its nutrition information. It has been found that older people (55+) read the food labels less often compared to younger people (25-54) (Aygen, 2012). The reason for older people to read nutrition information on food labels is most often because of health concerns (Grunert, & Wills, 2007). For older people in particular the font-size is an obstacle when reading the product label (Cowburn & Stockley, 2005).

The decision of consumers to purchase a certain product depends on different factors. The most important factors when buying food products among Europeans is found to be the origin (53%), cost (51%), food safety (50%), and taste (49%) of the product. Nutrition (44%) together with ethics and beliefs (19%) were found to be the least important (European Commission, 2019). It has been found that when consumers focus on labelling they particular look at the manufacturer. Other important

focusing factors are price, expiry date, energy, and fat content (Tarnavölgyi, 2003). A study has found that their respondents also looked at harmful ingredients when reading the product label. Most of the respondents also answered that a purchase decision was based on the label of the product. Only when the product contained a well-known brand the respondents focused less on the product label (Ward & Jauregui, 2006). In Turkey a study has found that the respondents mainly looked at the expiration date, production date, shelf life, name, brand of the product, and the ingredient list, when reading the product label. This was read more often by the respondents compared to the amount in which the nutrition information was read (Aygen, 2012). A study in the United Kingdom found that 27% of the observed people were looking at the nutrition information when purchasing a product. It depends on the product category in which amount consumers look for nutrition information on the product labels. In particular when the reason of the consumer to purchase a product is because of health or nutrition reasons, makes it more likely for them to look at the nutrition information of the product (Grunert, Wills & Fernández-Celemín, 2010).

However, consumers do not always read the nutrition information which is provided on the product label. A eye-tracking study has found that consumers mainly look centrally to the product labels. The attention of the consumer for nutrition information is a struggle (Bremmers & Purnhagen, 2018). Reasons for consumers to not read the nutrition information on a label is because of the time it takes, the font size, the difficulty to understand terms on the labels and their doubts on the correctness of the information provided (Cowburn & Stockley, 2005). Consumers do not always understand the information which is provided on the labels. A study in which 58% of the respondents answered that they did read the food labels, 55% of the respondents answered that they do not understand the nutrition information which is provided (Deakin, 2011). Another reason for consumers to not read the food label is that they do not trust the producer of the product (Van der Merwe & Venter, 2010).

Important findings for Regulation 1333/2008 are that safety is an important factor for buying a food product among European citizens (European Commission, 2019). A reason for consumers to not read the nutrition information is because, consumers do not understand terms on the labels and their doubts on the correctness of this information (Cowburn & Stockley, 2005). Terms which could not be understand by consumers are possibly E-numbers and the chemical names of these E-numbers. The correctness of the information given by the producers is not trusted by consumers even tough for food additives rules are set out in Regulation 1333/2008.

5. How consumers perceive food additives

To investigate the attitude of consumers towards E-numbers and clean labelling it is important to first look at how food additives are perceived by consumers. Therefore, this chapter aims to investigate how consumers perceive food additives as an ingredient by looking at the currently existing literature.

Factors influencing the perception of consumers towards food additives depends on the perception of risk, the experience of food scandals towards the ingredients and the trust processors of an individual (Aschemann-Witzel, Varela, & Peschel, 2019). Furthermore, there is a difference between the different food additives and how they are perceived. Food additives can be distinguished in a synthetic or a natural origin. It has been found that consumers prefer natural additives over chemical additives (Aschemann-Witzel, Varela, & Peschel, 2019).

When consumers are looking for nutrition information on a product 54% of them first looks at fat content, 35% at sugar content, 33% at calories, 20% at salt, 11% at saturates, and 10% at the additives (Grunert, Wills & Fernández-Celemín, 2010). From this information you could conclude that food additives are an important factor of the food label even though it is not the most important information according to the consumer. Therefore, it is also important that it is regulated by Regulation 1333/2008 to obligate processors in article 23 (1a) to put the food additives on the label of the product.

Ingredients are distinguished by consumers in different groups. Consumers link flavour-related ingredients to taste and flavour and they see this as basic, harmless, and natural. Sugar and syrups were linked to sweetening and were perceived as unhealthy. Ingredients with the function to change the consistency, texture, or appearance were described by the consumers as unknown, weird, dangerous, processed, chemical, unnatural, and unnecessary. Proteins were seen as healthy, plant, protein, harmless, and natural. It didn't matter on which product the ingredients were mentioned. However, there does exist a difference in the frequency in which words the different ingredients are described. In general flavour additives are seen as positive except when used as sweeteners. This study also concluded that protein is seen as an ingredient with a positive image. Sugar and syrups were mostly seen as negative, and unhealthy. Unknown ingredients are associated with processed, artificial, chemical, dangerous, unnatural, and unnecessary. This negative perception is linked in this study to the ''*avoidance of chemically perceived ingredients, the modern health worries and the preference for natural and avoidance of added ingredients''* (Aschemann-Witzel, Varela, & Peschel, 2019, p. 125). It has been found that a healthy diet is seen by 31% of the consumers as a diet with as few food additive containing products as possible (Wandel, 1997).

The best known food additive groups by consumers are colourants, flavour enhancers, artificial sweeteners, and preservatives. The additive group which the respondents were mostly concerned about were preservatives. Colourants were also seen as a safety danger. According to the respondents the most important reason for producers to use food additives is to get a better taste and flavour of the product. Other reasons which were mentioned are extend the shelf-life and improve the colour and shape of the product (Shim et al., 2011).

A negative attitude exists among consumer towards food additives. Half of the consumers are occasionally or frequently worried about the safety of food additives (Consumentenbond, 2010). In the European Union 36% of the citizens indicated that they are concerned about food additives. This study showed that 43% indicated that they knew about laws which make sure that the food is safe (European Commission, 2019). Nevertheless a previous study found that 76% of their respondents

believed that additives approved by the government were not safe. This believe came from the idea that there is not sufficient evidence on the safety of food additives. Respondents indicated that they distrusted the food manufacturers and as a result think that a safety risk exists for food additives (Shim et al., 2011). Only 36% of the respondents among the European citizens answered that they trusted food industries concerning the safety of food products (European commission, 2019). Media had an influence on this idea as well (Shim et al., 2011).

The aim of Regulation (EC) 1333/2008 on food additives to protect the human health with the rules for food additives might not be seen by consumers in the same way or seen as enough. Consumers see food additives as something unhealthy and something unsafe. Consequently, Regulation 1333/2008 might not be seen as sufficient by the consumer to protect their interests and the health of the consumer.

6. E-numbers

This chapter aims to investigate the consumers knowledge and attitude towards E-numbers. Therefore, this chapter will first give some background information about E-numbers. Secondly this chapter will set out the information found about the knowledge of consumers regarding E-numbers. The third part of this chapter will indicate how E-numbers are perceived by consumers.

6.1 Background

The European numbering system of identifying additives by the letter E which is followed by a 3- or 4-digit number is established by the European Community in the 1960s. This system was established to identify food additives, avoid misunderstanding of the chemical names, simplify the bureaucracy and protect the consumer. When the numbering system was introduced, consumers were not informed, for this reason a lot of distrust, confusion, and misconception still exists among them (Tarnavölgyi, 2003).

6.2 Consumers knowledge regarding E-numbers

There is a lot of confusion among consumers what a food additive or an E-number is and what it means. A study asked consumers to answer the question what an additive and E-number is, most respondents gave the wrong answer. Defining an E-number was more difficult for the respondents compared to answer the question what a food additive is (Tarnavölgyi & Molnár, 2004). There were more women than men who gave the right answer to these questions (Tarnavölgyi & Molnár, 2004). This could be related to the difference in interests between women and men towards nutrition information (Grunert, & Wills, 2007).

The study of Tarnavölgyi and Molnár (2004) also found that the education level had an effect on the purchase habits if the product included food additives. The food additives had a bigger effect on the purchase habits of respondents with a higher education level compared to the respondents with a lower education level. They also found a misconception of the respondents' knowledge of products containing food additives. An example of this, is the grading of the amount of food additives in butter and margarine. These two products were graded the same even though butter does not contain additives because this is not allowed by law. Nevertheless, both of these products were seen as products with a medium additive content (Tarnavölgyi & Molnár, 2004).

Another study found that consumers believe that E-numbers are dangerous. For example, they think that E-numbers are provoking allergies or they think that they are carcinogenic. When a label contains many additives this is perceived by the consumer as more negatively for your health comparing to a label which contains less additives. Another misconception of consumers is that when an E-number has a higher E-number this is more dangerous to your health compared to a lower E-number (Wandel, 1997).

In opposition a study has found that the consumers do know that the E-numbers have a technological function. Nevertheless, they also think that the only reason for processors to use E-numbers is to make the product more attractive wherefore they sell more and make profit. Besides, this study has found that consumers do know that there are food safety Regulations to protect human health, but they do not trust that these will be effective. They believe the testing period of the approving procedure of food additives to be too short and not being tested on interactions with other ingredients. They do not trust that the authorities are controlling the rules well enough, which they believe is used by processors to break the rules (Tarnavölgyi, 2003). Also a study in the EU shows that 43% knows about the

Regulations which protect the food safety but the awareness of how this system works is limited (European commission, 2019). From these results it can be concluded that consumers do not trust the current Regulation on food additives. Consequently, Regulation (EC) No. 1333/2008 on food additives is not reaching its aim like set in article 1 to protect the consumers interests.

Marking a food additive as an E-number results in the consumers having a negative attitude toward the product. Consumers think when using this E-number that there is something in the product which the processor is trying to hide. Nevertheless, it is also believed that in some cases food additives are necessary (Tarnavölgyi, 2003).

6.3 How do consumers perceive E-numbers

In a study in which the 36% of the participants answered that they had a very good knowledge of E-numbers. Showed that 51% of the respondents thought that E-numbers are causing harm to your health (Al-Harthy et al., 2017).

A study in which they compared a label of jam with E-numbers or a label in which the E-numbers were replaced by its chemical names is found that more respondents preferred the labels with the chemical names (39%). 23% of the respondents preferred the label with the E-numbers and 27% indicated that it didn't make a difference on their purchasing behaviour. Among the respondents the higher educated respondents and the respondents who were particularly interested in additives choose more often for the label with the chemical names (Wandel, 1997).

A study who investigated if consumers actually prefer natural ingredients found that a short ingredient list is perceived as more natural and healthier compared to a long ingredient list. This study gave the participants a soup with the unnatural ingredient list including E-numbers and a soup with the natural ingredient list which used few words to describe the ingredients. The participants were asked to evaluate the product. This study found that most participant did not include the ingredient list in their motivation of their evaluation of the soup. Most participants did not see the difference in natural and unnatural ingredient list (Cheung et al., 2016). This study points out that consumers only consider the ingredient list when they are asked about the naturalness of the product. Besides, the fact that this study shows that the ingredient lists with E-numbers are not reaching the majority of the consumers you could also conclude that clean labels are not making a big difference for purchasing a product.

On the other hand the study, of Tarnavölgyi and Molnár (2004) indicated that most of their respondents answered to prefer products which contained less additives if they had the same quality and price. They also indicated that they would like additive-free products (Tarnavölgyi & Molnár, 2004). When looking at this study it could be that clean labels do have a positive contribution to reach the interest of the consumer.

It can be concluded that in general consumers have a negative attitude towards E-numbers. Besides clean labels could have shorter ingredient lists, because of the minimally use of food additives in these products, which is preferred by the consumer. For clean labels this could mean that consumers would prefer these over the regular E-number labels.

7. Clean labels

This chapter aims to investigate the consumers knowledge and attitude towards clean labelling. Therefore, this chapter will first give some background information about clean labelling. Secondly this chapter will set out the information found about the knowledge of consumers regarding clean labelling. The third part of this chapter will indicate how clean labels are perceived by consumers.

7.1 Background

The increasing demand of consumers for products with easy to read and recognizable ingredients causes a new challenge for the food manufactures. As a result, a new trend of clean labelling is arising. At this moment there is no official definition of a clean label described by the European Union (Asioli et al., 2017).

Food companies that want to use clean labels can use the claims *additives free* or *free from preservatives*. To use these claims they have to be true and it has to be possible by law to use food additives in the products for which *additives free* or *free from preservatives* is claimed. It is not allowed to use a claim and let the consumer believe that the product has a special characteristic if all other similar product possess the same characteristics (Carreño & Vergano, 2015).

There is also a disadvantage due to clean labelling. To make clean labelling possible the ingredients of the product have to change and therefore processes have to change. This could affect the quality and the characteristics of the product. In particular the sensory aspects are seen as a barrier for clean labelling. For example, rosemary and oregano have a big impact on the taste and smell of the product. They do not match with sweet or natural products but they do match with savoury sauces. These changes in composition could also have an effect on the efficiency of preventing spoilage. Some ingredients are more effective in preventing spoilage than others (Chen & Hart, 2016). This could cause a problem for the protection of the human health which Regulation 1333/2008 aims to protect.

7.2 Consumers knowledge regarding clean labelling

The definition of clean label is subjective and depends on the knowledge of the consumer towards ingredients, the production methods, and the conclusions drawn from this (Asioli et al., 2017). Besides, clean labelling is seen as an umbrella term for everything which is preferred by the consumer on the label of the products. Therefore, clean labels should not have difficult ingredients on them, which are not known to consumers. As a result, E-numbers are not used in these products or they only make use of a few E-numbers (Minneboo, 2017). At this moment by consumers a clean label is seen as simple and easy to read label with recognizable ingredients, minimal processed, or processed with traditional techniques (Xue, Davidson, Zhong, 2013).

The knowledge of consumers and ingredients interpreted as familiar depends on the country. It is also found that consumers try to avoid unfamiliar ingredients or food additives which are associated with artificial chemicals. They also try to avoid production methods which are seen as unnatural. A study showed that 53% of the consumers are avoiding at least 5 ingredients (Asioli et al., 2017). In the European Union a study among European citizens has found that 66% of the respondents changed their consumption because of information received about safety risks of food products. Of these respondents 33% indicated to have changed their consumption permanently (European commission, 2019).

It is also found that consumers interpret a product as being clean label when the label states that it is *''natural, organic, free from artificial ingredients, free from allergens, no GMO's, minimally processed, simple/short ingredient lists and transparent packaging'' (p. 12, 13)*. Consumers could also interpret a product as clean label by studying the ingredient list or nutrition table (Asioli et al., 2017).

7.3 How do consumers perceive clean label products

The negative attitude of consumers towards chemicals, functional food development and unknown ingredients can be a reason for consumers to choose for clean label product. It is already shown that this is a reason for consumers to choose organic food. The reason for consumers to prefer familiar ingredients is explained by the driver to eat healthy, an environment friendly or sustainable supply chain, preference for local ingredients, or their avoidance of risks. It has been found that consumers prefer natural additives over chemical additives (Aschemann-Witzel, Varela, & Peschel, 2019). This could be a reason for consumers to prefer a clean label over a label which do include E-numbers.

Different ingredients have a different meaning to consumers and can be perceived positively or negatively (Aschemann-Witzel, Varela, & Peschel, 2019). For clean labelling this could mean that not all additives need to be avoided when clean labelling is used. When consumers look at how healthy a product is they look at the degree of processing across product categories (Aschemann-Witzel, Varela, & Peschel, 2019). For clean label products this could mean that they are seen as healthier compared to E-number including labels.

8. Results

In this chapter the results of the questionnaire are set out. These results aim to investigate if consumers prefer clean labels or E-number including labels. First the demographics of the respondents are described and then the crosstabs will be discussed in 8.2. In 8.3 the result on how the label information in perceived by the respondents will be discussed. In 8.4 Friedman's two-way analysis will be discussed. In 8.5 the results of the questions about the naturalness of ingredient lists are described. In 8.6 the results of the questions about health are shown. In 8.7 the results of the questions about safety are set out. In 8.8 the results of the questions about readability are set out. In 8.9 the results on the questions about recognizability are set out. Finally in 8.10 the results about the knowledge of the respondents are set out.

8.1 Demographics of respondents

There are 212 people who responded to the questionnaire. There are three people excluded from this study because they answered that they do not live in the European Union. There are 42 respondents excluded from the results because they did not complete the questionnaire. This means that the results of 167 respondents are analysed. In chart 1 the gender of the respondents are indicated. Of the 167 respondents 33,3% answered that they are male, 64,9% answered that they are female, and 1,8% didn't want to answer this question.

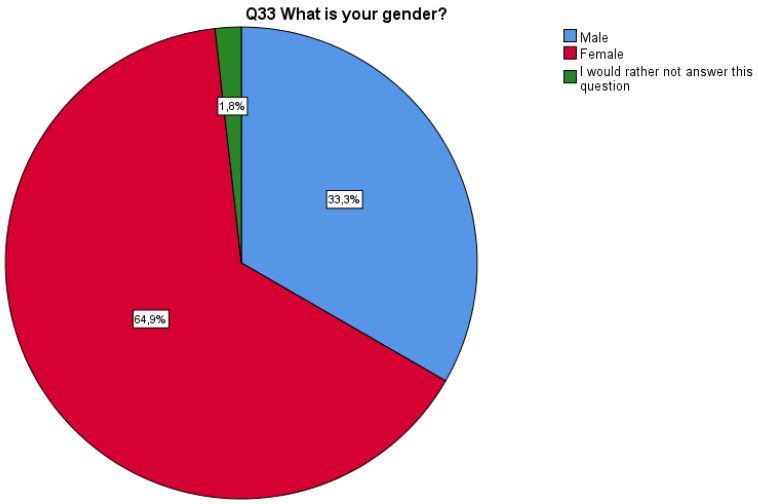

Chart 1: Q33 What is your gender

In chart 2 the age of the respondents are indicated. Most of the respondents (79,8%) have an age between 21-30 years, 6,0% has an age of 20 years or younger, 5,4% has an age between 31-40, 3,0% has an age between 41-50, 5,4% has an age between 51-60. The remaining 0,6% of the respondents

indicated that they would rather not answer this question.

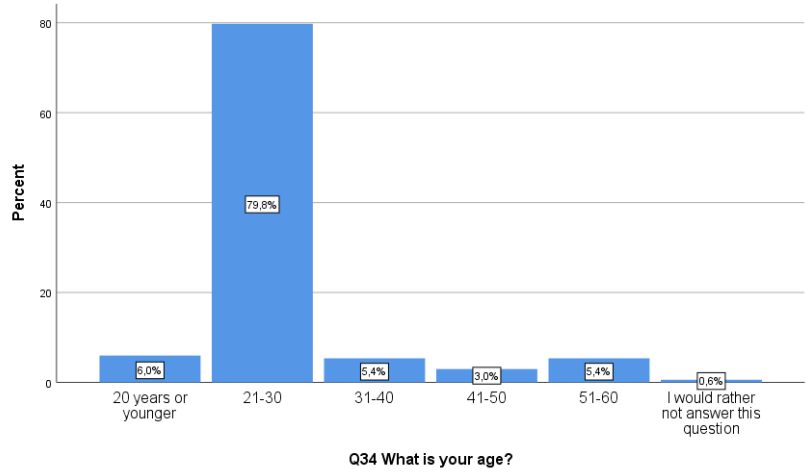

Chart 2: Q34 What is your age?

In chart 3 the highest level of completed education of the respondents is indicated. Most of the respondents (82,1%) indicated that they completed a higher education, 10,1% indicated secondary education, 6,0% indicated secondary vocational education, 1,2% indicated that they would rather not answer this question, and 0,6% of the respondents answered other and indicated to have finished high school.

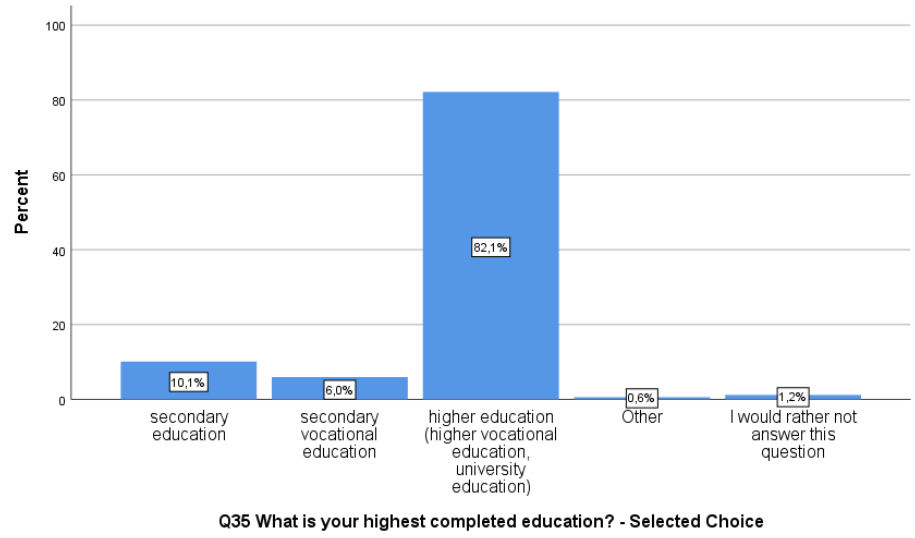

Chart 3: Q35 What is your highest completed education?

From chart 4 it becomes clear that 97,6% of the respondents are living in the Netherlands. Other countries in which respondents live are Germany and Italy. The remaining respondents (1,2%) answered

that they would rather not answer this question.

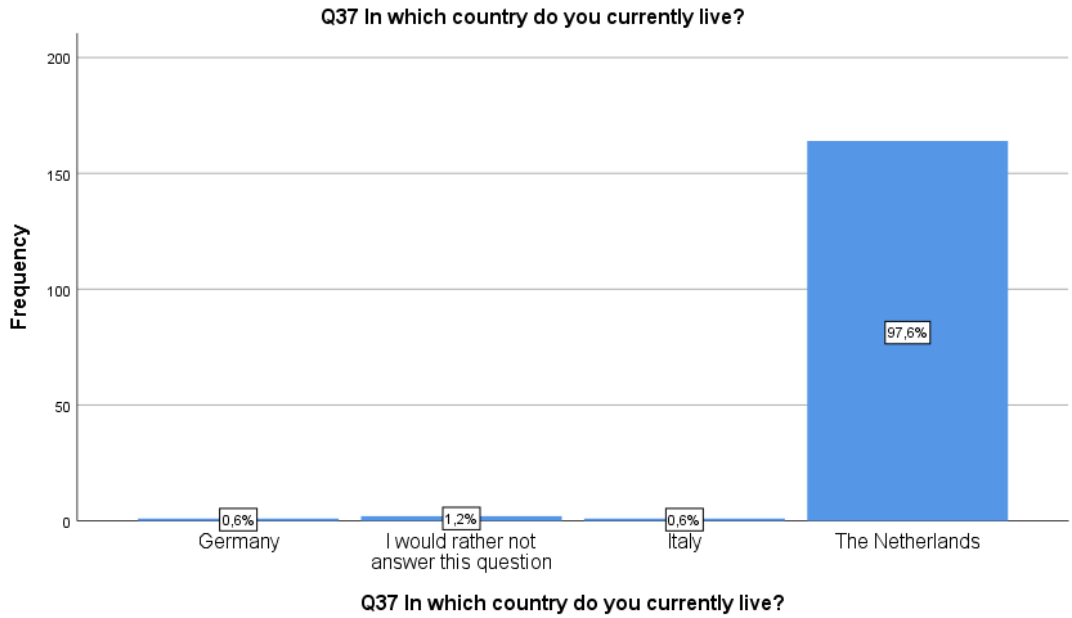

Chart 4: Q37 In which country do you currently live?

From the results of question 38 (Chart 5: Q38 Is the country you're living in the same as your country of origin) it can be concluded that 68,5% of the respondents are born in the Netherlands, 29,2% of the respondents answered that the country in which they are living is not the same as the country in which they are born. The countries in which they are born are set out in table one.

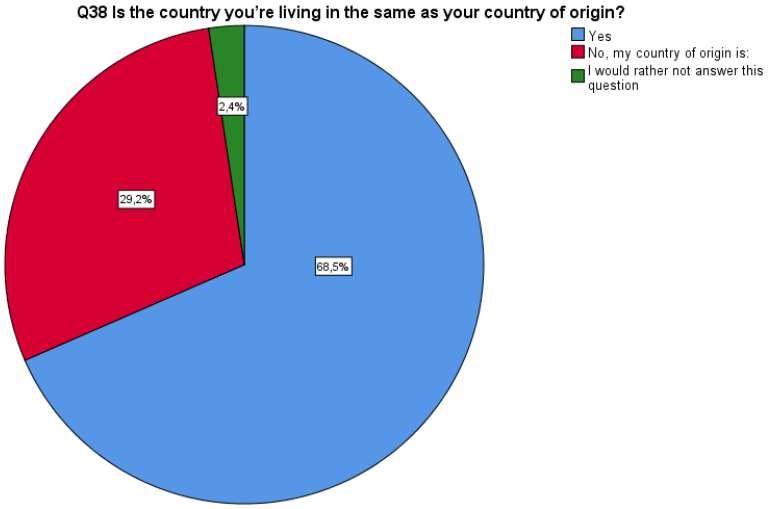

Chart 5: Q38 Is the country you're living in the same as your country of origin?

Table 1: Q38 Is the country you're living in the same as your country of origin?

Q38_6_TEXT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		124	73,8	73,8	73,8
	Austria	1	,6	,6	74,4
	Bhutan	1	,6	,6	75,0
	china	2	1,2	1,2	76,2
	China	6	3,6	3,6	79,8
	CHINA	1	,6	,6	80,4
	Ecuador	1	,6	,6	81,0

	France	1	,6	,6	81,5
	Germany	5	3,0	3,0	84,5
	Greece	7	4,2	4,2	88,7
	India	1	,6	,6	89,3
	INDIA	1	,6	,6	89,9
	Ireland	1	,6	,6	90,5
	Italy	1	,6	,6	91,1
	Peru	1	,6	,6	91,7
	Poland	1	,6	,6	92,3
	ROK	1	,6	,6	92,9
	RW	1	,6	,6	93,5
	Rwanda	1	,6	,6	94,0
	Slovandia	1	,6	,6	94,6
	Spain	4	2,4	2,4	97,0
	Swedand	1	,6	,6	97,6
	Thailand	1	,6	,6	98,2
	The Netherlands	2	1,2	1,2	99,4
	United states of America	1	,6	,6	100,0
	Total	168	100,0	100,0	

Chart 6 tells us that most of the respondents (59,3%) answered yes on the question if they had a background wherefore they already knew what E-numbers are and 40,7% answered no on this question.

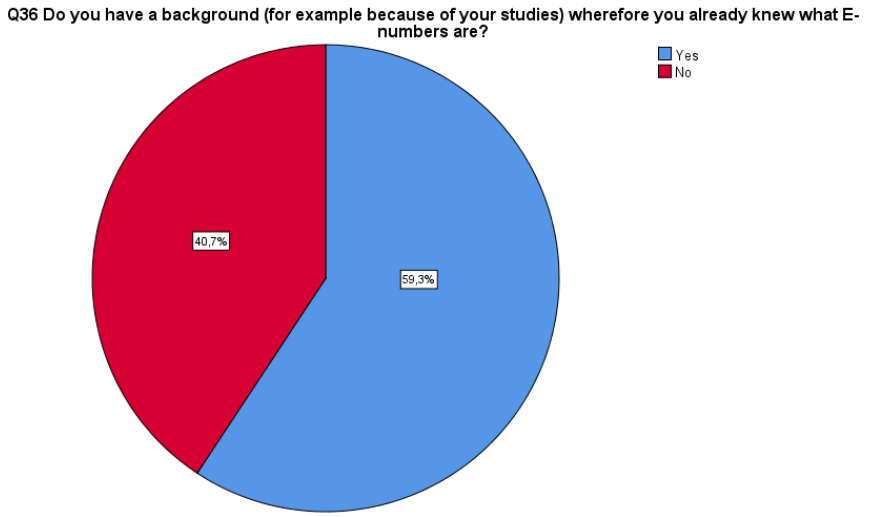

Chart 6: Q36 Do you have a background (for example because of your studies) wherefore you already knew what E-numbers are?

8.2 Crosstabs

The fact that most of the respondents have a background wherefore they knew what E-numbers are could have an influence on the other questions of the questionnaire. Their background could have an influence on question 11 in which is asked if they know what food additives are, on question 13 in which was asked if the respondents knew what E-numbers are and on question 23 in which is asked if they know what clean labels are. Crosstabulations are used to investigate if the background of the respondents has an influence on the answers of question 11, 12, and 13.

Table 2 compares the answers of question 11 with the answers of question 36. In general most respondents answered that they knew what food additives are (142 of 167). The respondents who answered no on question 36 answered more often no (23 of 86) on question 11, compared to

respondents answering yes on question 36 and no on question 11 (2 of 99). This comparison has a Pearson's rate of 0,44 which means that there is a weak relationship between these variables.

Table 2: Q11 Do you know what food additives are compared to Q36 Do you have a background wherefore you already knew what E-numbers are?

Q11 Do you know what food additives are? * Q36 Do you have a background (for example because of your studies) wherefore you already knew what E-numbers are? Crosstabulation

Count

		Q36 Do you have a background (for example because of your studies) wherefore you already knew what E-numbers are?		
		Yes	No	Total
Q11 Do you know what food additives are?	Yes	97	45	142
	No	2	23	25
Total		99	68	167

Table 3 shows a comparison of the answers to question 36 and question 13. Most respondents answered yes on the question if they knew what E-numbers are (151 of 167). From the respondents who answered no on question 36, 14 of the 86 people also answered no on question 13 this is more compared to the group who said yes on question 36 and no on question 13 (2 of 99). This comparison has a Pearson's rate of 0,31 which means that there is a weak relationship between these variables.

Table 3: Q13 Do you know what E-numbers are? Compared to Q36 Do you have a background wherefore you already knew what E-numbers are?

Q13 Do you know what E-numbers are? * Q36 Do you have a background (for example because of your studies) wherefore you already knew what E-numbers are? Crosstabulation

Count

		Q36 Do you have a background (for example because of your studies) wherefore you already knew what E-numbers are?		
		Yes	No	Total
Q13 Do you know what E-numbers are?	Yes	97	54	151
	No	2	14	16
Total		99	68	167

Table 4 compares the answers on question 23 with the answers on question 36. Most respondents answered no (104 of 167) on question if they know the concept of clean labelling (question 23). From the people who answered 57 no on question 23 of the 68 people who answered no on question 36. This is a bigger group compared to respondents who answered yes on question 36 and no to question 23 (47 of 99). This comparison has a Pearson's rate of 0,37 which means that there is a weak relationship between these variables.

Table 4: Q23 Do you know the concept of clean labelling? Compared to Q36 Do you have a background wherefore you already knew what E-numbers are?

Q23 Do you know the concept of clean labelling? * Q36 Do you have a background (for example because of your studies) wherefore you already knew what E-numbers are? Crosstabulation

Count

		Q36 Do you have a background (for example because of your studies) wherefore you already knew what E-numbers are?		
		Yes	No	Total
Q23 Do you know the concept of clean labelling?	Yes	52	11	63
	No	47	57	104
Total		99	68	167

8.3 Perceived label information

Chart 7 gives an overview of the answers on the question if the respondents read the food labels of the food products. Only 3,6% of the respondents answered that they never read the food labels. Other respondents answered sometimes (36,9%), about half of the time (18,5%), most of the time (30,4%), or always (10,7%) as set out in chart 7. In chart 8 an overview of the answers is given to the question if the respondents looked at the ingredient lists of food products. Compared to the answers of question 3 there are more respondents who answered that they are never (5,4%) or sometimes (41,1%) reading the ingredient lists of food products compared to the respondents who read food labels. Less of the respondents answered that they read the ingredients lists half of the time (18,5%), most of the time (28,0%), or always (7,1%) compared to the question if the respondents read food labels. The fact that respondents answered that they read the food labels but do not look at the ingredient list, could be explained by them looking at different attributes of the food label.

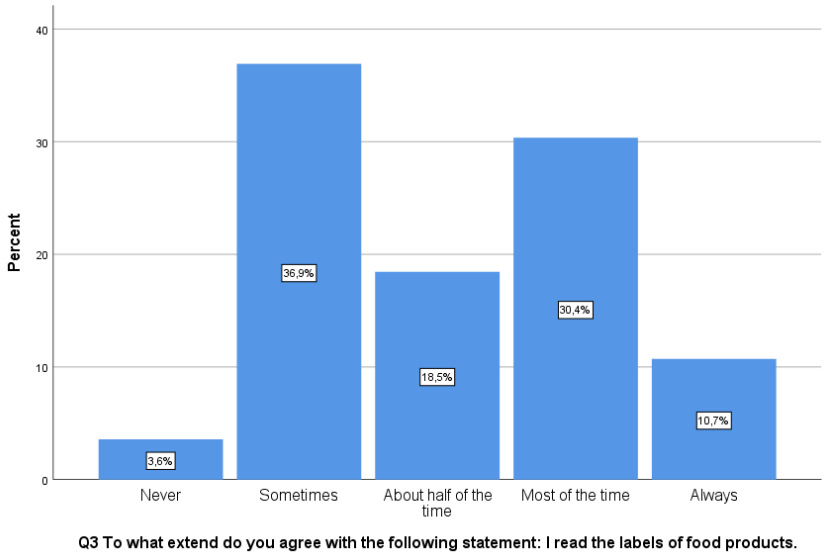

Chart 7: Q3 To what extend do you agree with the following statement: I read the labels of food products.

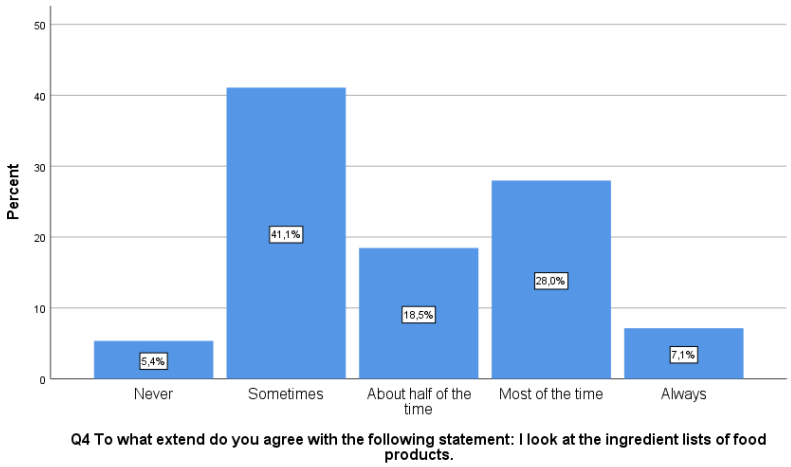

Chart 8: Q4 To what extend do you agree with the following statement: I look at the ingredient lists of food products.

Chart 9 indicates the answers of the question if they avoid buying food products if they contain ingredients which are unknown to them. From the respondents 59,5% answered never. The other respondents answered sometimes (31,0%), about half of the time (4,8%), most of the time (3,6%), or always (1,2%) as set out it graph 10. A reason for respondents to read the ingredient list could be to avoid food products if it contains unknown ingredients.

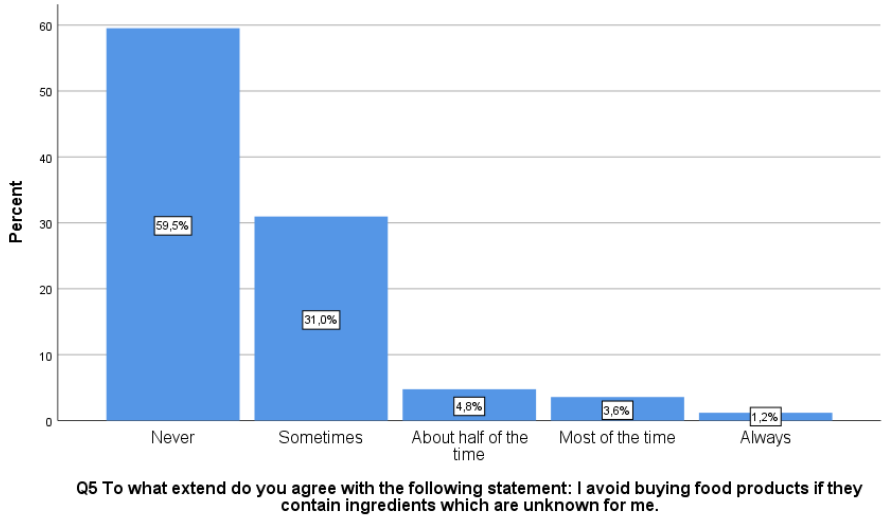

Chart 9: Q5 To what extend do you agree with the following statement: I avoid buying food products if they contain ingredients which are unknown for me.

In chart 10 the answers on the question if the respondents looked at the E-numbers when reading an ingredient list are set out. From the respondents 34,5% answered never the other respondents answered sometimes (38,1%), about half of the time (10,1%), most of the time (9,5%), or always (7,7%) as set out in graph 11. This means that looking at the E-numbers could be a reason for the respondents to look at the ingredient lists of food products.

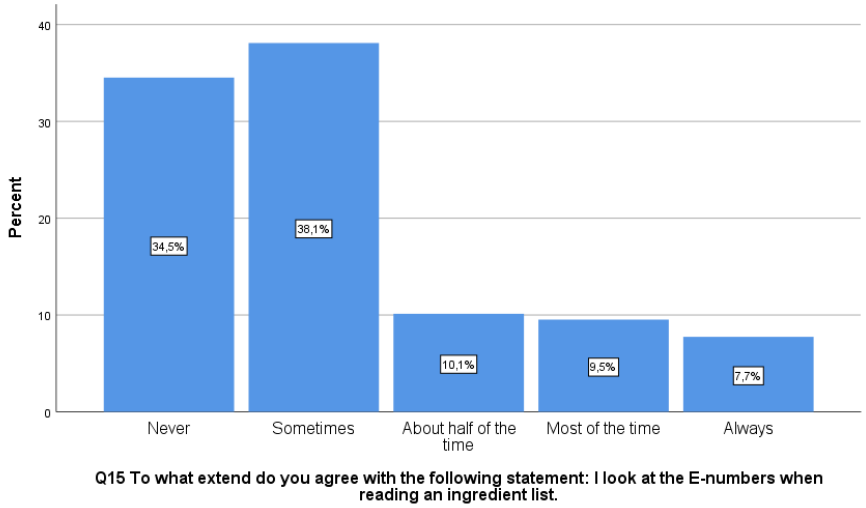

Chart 10: Q10 To what extend do you agree with the following statement: I look at the E-number when reading an ingredient list.

In chart 11 the answers to the question if the respondents avoid products which contain E-number is set out. Most of the respondents answered never (69,6%) the other respondents answered sometimes (24,4%), about half of the time (4,2%), or most of the time (1,8%) as set out in chart 11. From these results you could conclude that most respondents never avoid food product with the reason of containing E-numbers. In table 5 the correlation between question 16 and question 31 is set out. In question 31 the respondents are asked which ingredient list they prefer, (option A= ingredient list with only chemical names of E-numbers, option B= ingredient list without E-numbers (which represents a clean label ingredient list), option C= ingredient list with chemical names and E-numbers, and option D= ingredient list with E-numbers without the chemical names) the results show that respondents who avoid E-numbers not necessary prefer an ingredient list without E-numbers. The Pearson's relation gives a value of -0,034 which means that there is a weak correlation between the answers of question 31 and question 16.

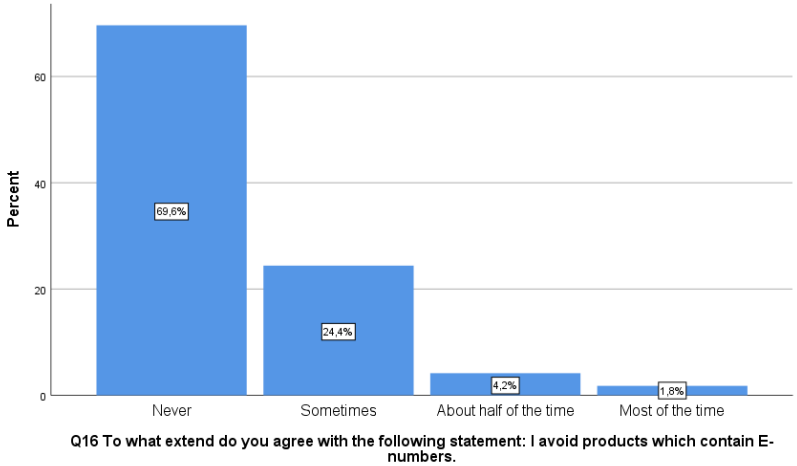

Chart 11: Q16 To what extend do you agree with the following statement: I avoid products which contain E-numbers.

Table 5 comparison of question 16 To what extend do you agree with the following statement: I avoid products which contain E-numbers and question 31 Which of the ingredient lists do you prefer the most?

Q16 To what extend do you agree with the following statement: I avoid products which contain E-numbers. * Q31 Which of the ingredient lists do you prefer the most? Crosstabulation

Count

		Q31 Which of the ingredient list do you prefer the most?					
		Option A	Option B	Option C	Option D	No preference	Total
Q16 To what extend do you agree with the following statement: I avoid products which contain E-numbers.	Never	27	35	37	9	9	117
	Sometimes	7	19	10	2	3	41
	About half of the time	1	4	2	0	0	7
	Most of the time	1	1	0	0	1	3
Total		36	59	49	11	13	168

8.4 Friedman's two-way analysis

Chart 12 indicated Friedman's two-way analysis in which question 6, 7, 8, 9, and 10 are compared. These questions are scale questions wherefore they can be compared with each other by Friedman's two-way analysis. These questions had a scale of 1 till 5 in which 1=not important and 5=very important. The mean rank of question 8 about the safety is 3,98. This is the highest mean rank of the scale questions. The mean rank of question 9, about readability, is 3,51. The mean rank of question 10, about recognizable ingredients, is 2,79. The mean rank of question 7, about beneficial to health, is 2,85. The mean rank of question 6, about natural ingredients is 1,88. From this chart it can be concluded that most of respondents found the safety of food products the most important because of the highest mean rank which is given to this question.

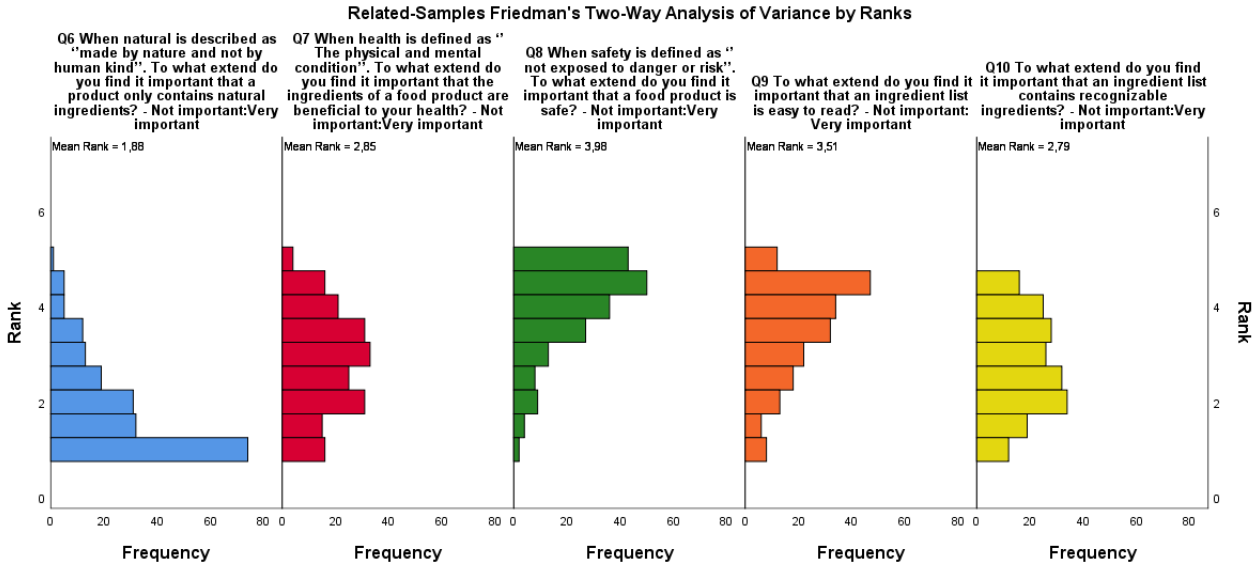

Chart 12 Friedman's Two-Way analyses of variance by rank

8.5 Ingredient lists being natural

Chart 13 sets out the results of question 19 about the acceptance of chemical achieved E-numbers added to food products. Most of the respondents find this acceptable (37,5%) or somewhat acceptable (37,5). Only 1,2% of the respondents finds this unacceptable and 10,7% finds this somewhat acceptable. From the respondents 10,1% finds this neither acceptable nor unacceptable and 3,0% answered that they do not know. When comparing these results with the results of question 20, in chart 14,

about the expectance of naturally achieved E-numbers added to food products, it can be observed that the answers to this question are more concentrated towards acceptable. From the respondents 62,5% answered that they found this acceptable and 23,8% answered that they found this somewhat acceptable. Only 1,8% of the respondents found this unacceptable and 3,6% found this somewhat unacceptable. The other respondents found this neither acceptable nor unacceptable (6,0%) or answered that they don't know.

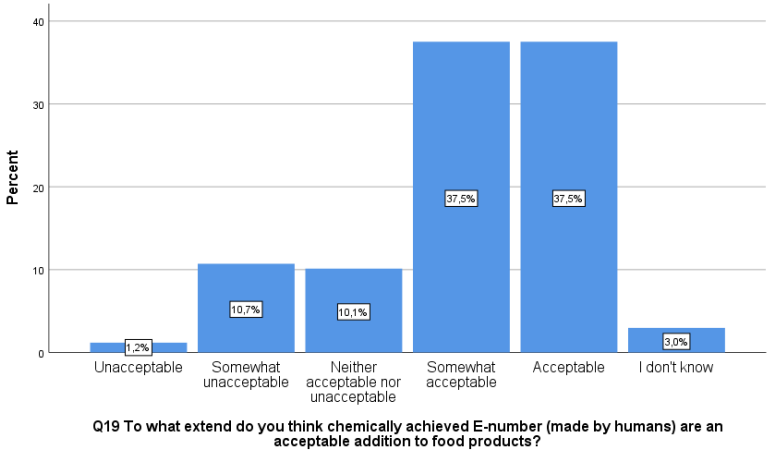

Chart 13: Q19 To what extend do you think chemically achieved E-numbers (made by humans) are an acceptable addition to food products?

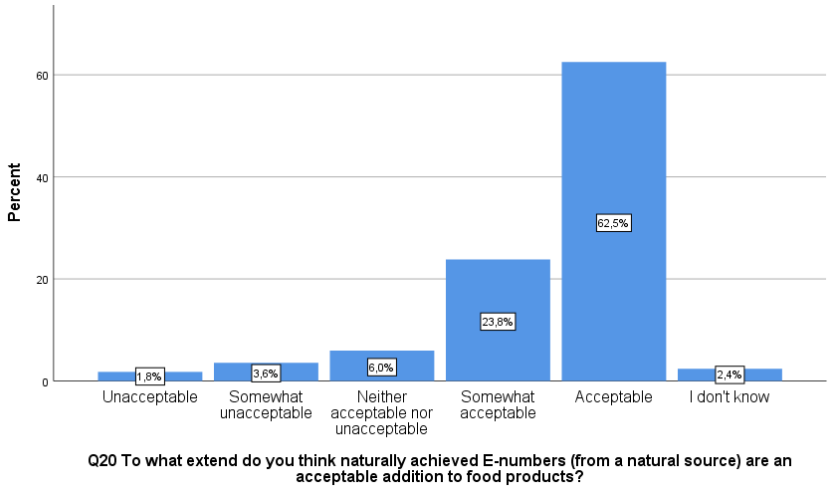

Chart 14: Q20 To what extend do you think naturally achieved E-numbers (from a natural source) are an acceptable addition to food products?

Chart 15 sets out the answers of question 28 about the most natural ingredient list from the choices given. Option A= ingredient list with only chemical names of E-numbers, option B= ingredient list without E-numbers (which represents a clean label ingredient list), option C= ingredient list with chemical names and E-numbers, and option D= ingredient list with E-numbers without the chemical names. Like shown in chart 16, most of the respondents (60,7%) found option B the most natural.

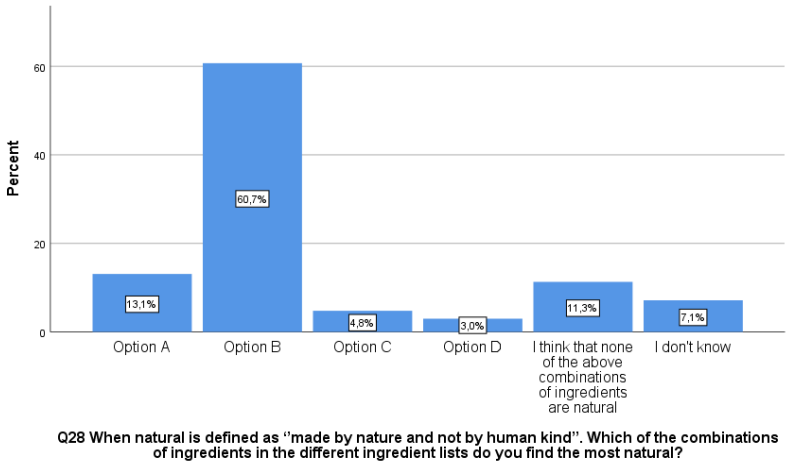

Chart 15: Q 28: When natural is defined as ''made by nature and not by human kind''. Which of the combinations of ingredients in the different ingredient lists do you find the most natural?

8.6 Health

Chart 16 sets out the answers to question 17 in which is asked to what extend the respondents think E-numbers are healthy. Most of the respondents answered neither healthy nor unhealthy (51,8%) and 8,3% of the respondents answered that they don't know. The other responses are more concentrated towards the more negative answers, unhealthy (6,0%), and somewhat unhealthy (20,8%). Only 4,2% gave the answer somewhat healthy and 8,9% answered healthy.

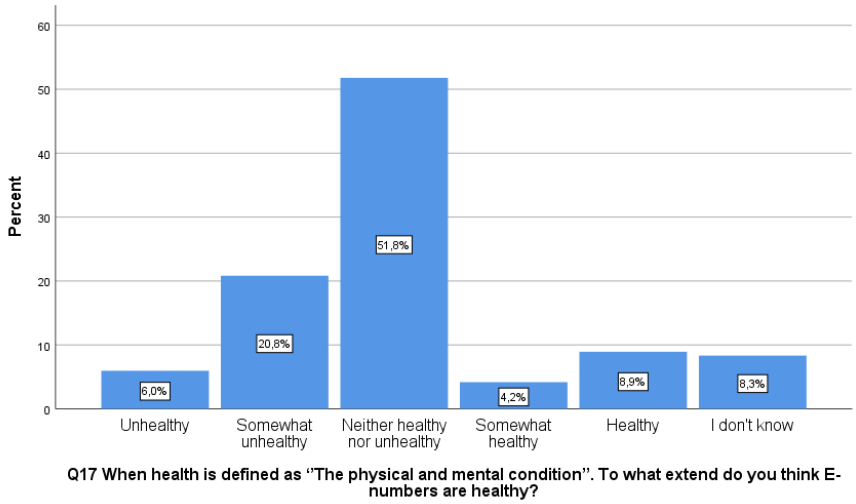

Chart 16: Q17 When health is defined as 'The physical and mental condition'. To what extend do you think E-numbers are healthy?

Chart 17 sets out the results of question 26 in which is asked which of the ingredient lists in the choices given is the most beneficial for your health. Option A= ingredient list with only chemical names of E-numbers, option B= ingredient list without E-numbers (which represents a clean label ingredient list), option C= ingredient list with chemical names and E-numbers, and option D= ingredient list with E-numbers without the chemical names. Most of the respondents choose option B (41,7%). The other respondents chose option A (10,7%), option C (20,8%), option D (1,8%), I don't know (12,5%), or the option: I think that none of the above combinations of ingredients are beneficial for your health (12,5).

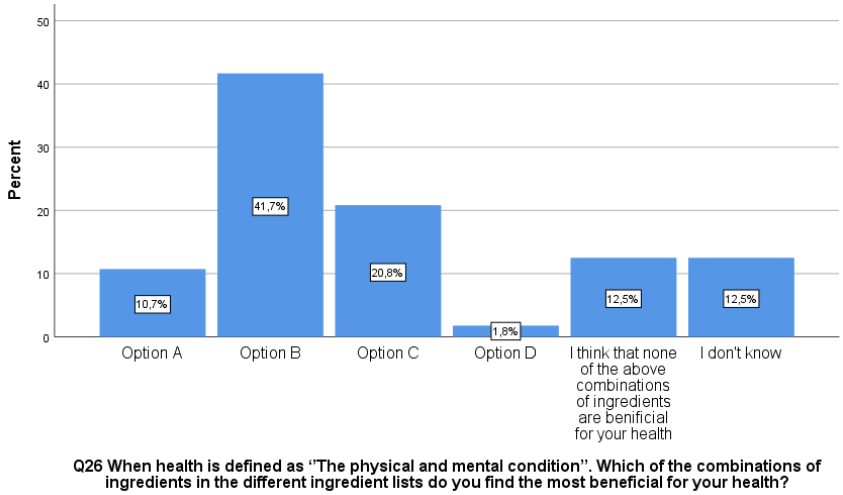

Chart 17: Q26 When health is defines as 'The physical and mental condition'. Which of the combinations of ingredients in the different ingredient lists do you find the most beneficial for your health?

8.7 Safety

Chart 18 sets out the answers on question 18 in which is asked to what extend the respondents think that E-numbers are safe. Most of the respondents answered that they think that it is safe (44,0%). The other respondents answered that they think it is somewhat safe (15,5%), Neither safe nor unsafe (21,4%), somewhat unsafe (10,7%), or unsafe (1,8%). The remaining respondents answered they didn't knew (6,5%).

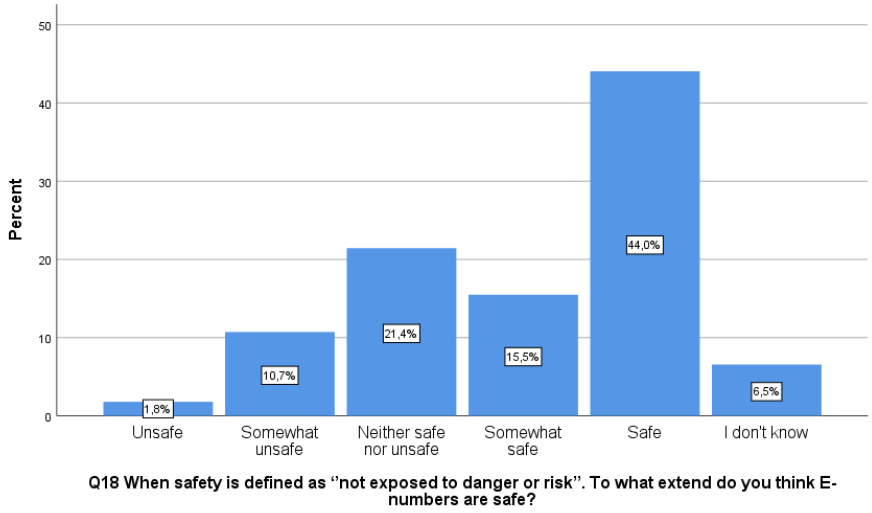

Chart 18: Q18 When safety is defined as ''not exposed to danger or risk''. To what extend to you think E-numbers are safe?

Chart 19 sets out the results of question 27 in which is asked which of the ingredient lists in the choices given is the most beneficial for your health. Option A= ingredient list with only chemical names of E-numbers, option B= ingredient list without E-numbers (which represents a clean label ingredient list), option C= ingredient list with chemical names and E-numbers, and option D= ingredient list with E-numbers without the chemical names. Most of the respondents indicated option B (41,7%) as the safest option. The other respondents indicated option A (13,1%), option C (17,3%), or option D (6,0%) as the safest option. The remaining respondents indicated that they didn't knew (18,5%) or that they think that none of the combinations of ingredients are safe (3,6%).

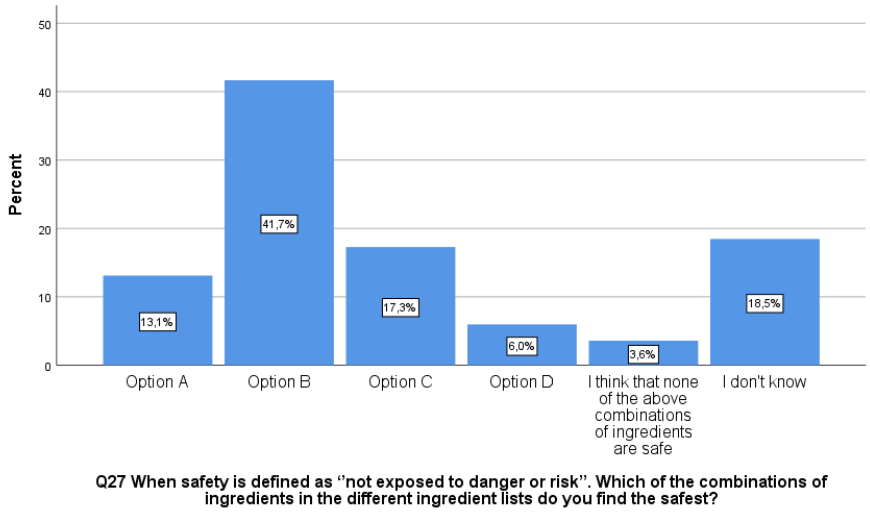

Chart 19: Q27 When safety is defined as ''not exposed to danger or risk''. Which of the combinations of ingredients in the different ingredient lists do you find the safest?

8.8 Easy to read

Chart 20 sets out the answers on question 21 about E-numbers making it easier to read the ingredient list. Most of the respondents (36,9%) answered somewhat difficult and 16,1% answered difficult. From the respondents 7,7% indicated that they found this easy and 12,5% indicated that they found this somewhat easy. The remaining respondents (21,4%) answered that they found this neither difficult nor easy. From these answers it can be concluded that most of the respondents find the system of E-numbers making it difficult to read the ingredient list of food products.

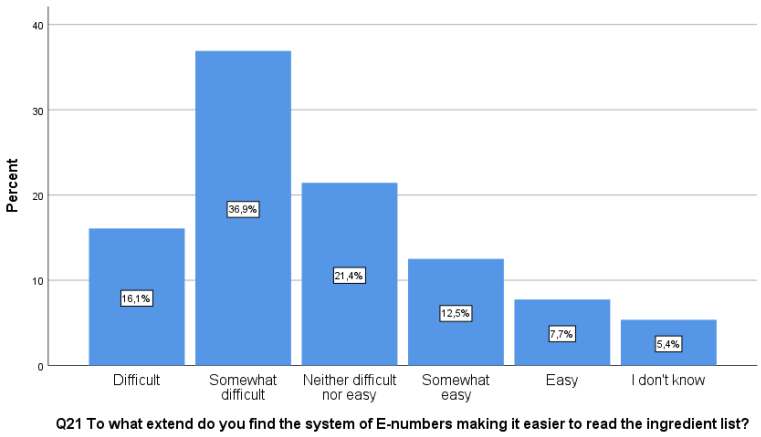

Chart 20: Q21 To what extend do you find the system of E-numbers making it easier to read the ingredient list?

Chart 21 sets out the results of question 29 in which is asked which of the ingredient lists in the choices given is the easiest to read. Option A= ingredient list with only chemical names of E-numbers, option B= ingredient list without E-numbers (which represents a clean label ingredient list), option C= ingredient list with chemical names and E-numbers, and option D= ingredient list with E-numbers without the chemical names. Most of the respondents indicated that they found option B (53,6%) the easiest to read. Option A was chosen by 23,8% of the respondents, option C by 10,7% of the respondents, and option D by 7,1% of the respondents. The remaining 4,8% indicated that they did not know.

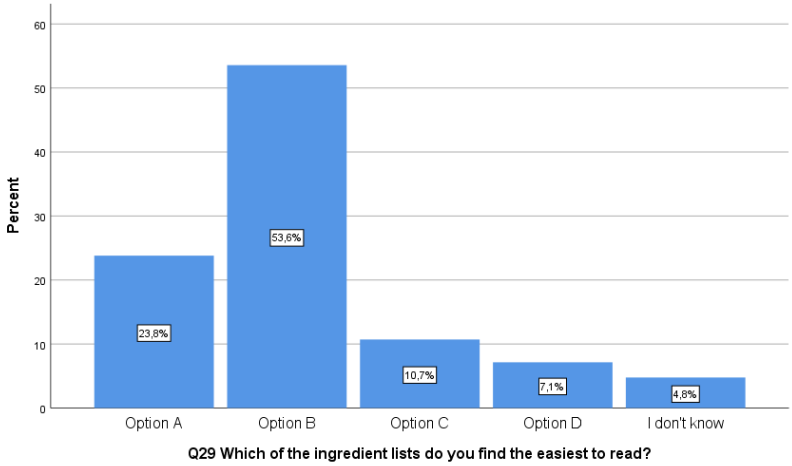

Chart 21: Q29 Which of the ingredient lists do you find the easiest to read?

8.9 Recognizable ingredients

Chart 22 sets out the answers on question 22 about E-numbers and if they make a recognizable way of indicating an ingredient. Most of the respondents (38,1%) find E-numbers a somewhat recognizable way of indicating E-numbers. Of the respondents 19,6% finds this unrecognizable, 10,7% finds this neither unrecognizable nor recognizable, 15,5% find this somewhat recognizable, and 8,9% finds this recognizable. Only 1,7% of the respondents answered that they didn't knew.

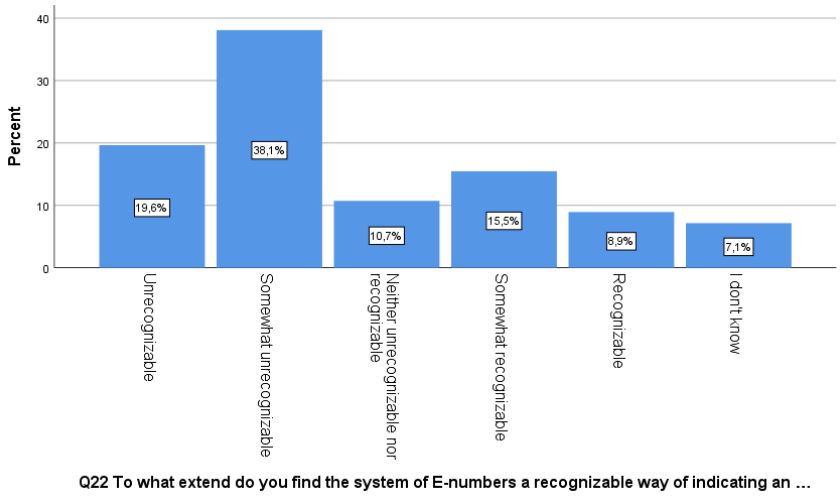

Chart 22: Q22 To what extend do you find the system of E-numbers a recognizable way of indicating an ingredient?

Chart 23 sets out the results of question 30 in which is asked which of the ingredient lists in the choices given is the most recognizable. Option A= ingredient list with only chemical names of E-numbers, option B= ingredient list without E-numbers (which represents a clean label ingredient list), option C= ingredient list with chemical names and E-numbers, and option D= ingredient list with E-numbers without the chemical names. Most of the respondents (35,1%) indicated that they found option B the most recognizable option. Of the other respondents 16,1% chose option A, 26,8% chose option C, and 14,9% chose option D. Only 3,0% of the respondents indicated that they found none of these ways of indicating the ingredients in the ingredient list a recognizable option and 4,2% found all of these options recognizable.

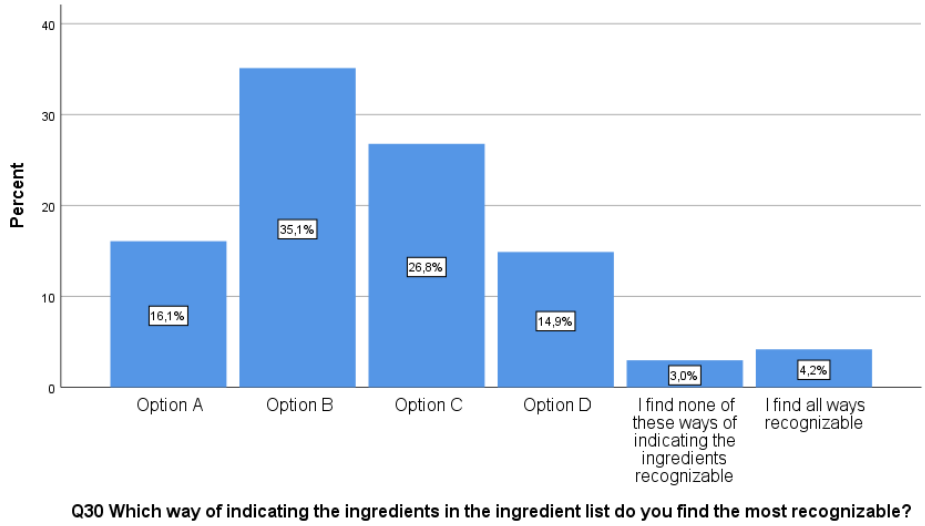

Chart 23: Q30 Which way of indicating the ingredients in the ingredient list do you find the most recognizable?

8.10 Knowledge of respondents.

Chart 24 sets out the answers to question 23 which asked if the respondents knew what the concept of clean labelling is. Most of the respondents (61,9%) of the respondents answered no to this question. Only 38,1% of the respondents answered yes to this question. In chart 25 the answers to question 24 are set out in which is asked how they would describe what clean labelling is. Most of the respondents (39,9%) answered that they would describe it as a product which only consists out of recognizable ingredients. A big part of the respondents (32%) indicated that they didn't knew. Other description which are mentioned are: as something which could be dangerous to my health (1,1%), as something unfamiliar (6,2%), as a product with no E-numbers (7,3%), as a product which only consists ingredients which are naturally (7,3%), a marketing trick, a label which is easy to navigate, easy to understand, honest labelling, a label which is very clear, concise, and accurate.

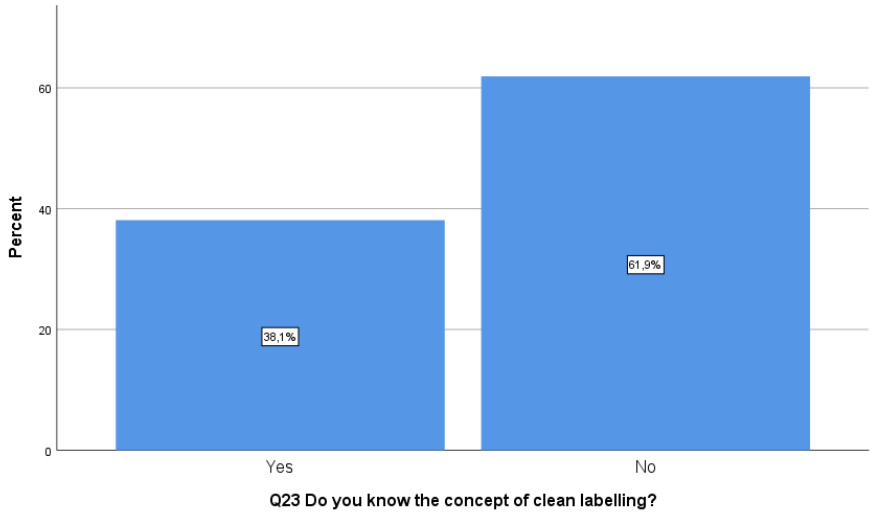

Chart 24: Q23 Do you know the concept of clean labelling?

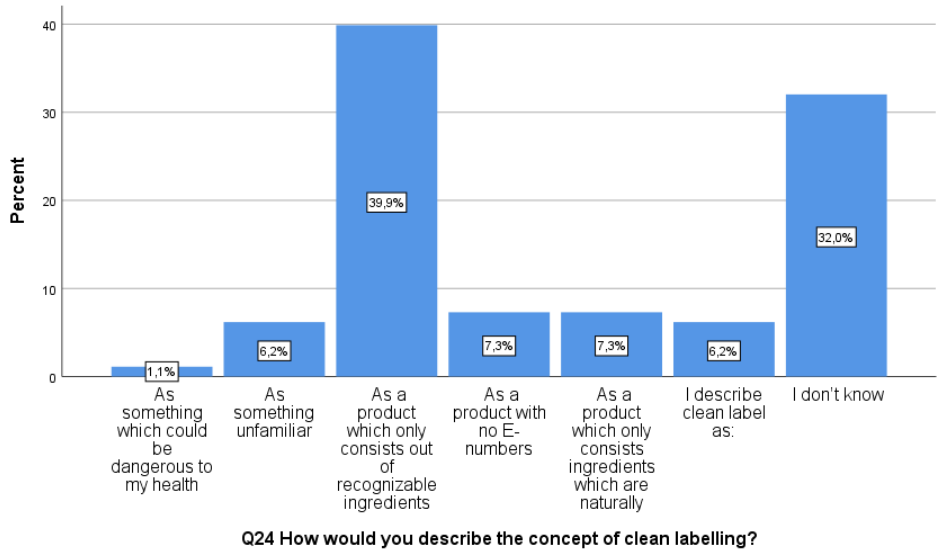

Chart 25: Q24 How would you describe the concept of clean labelling?

Chart 26 sets out the answers of question 11 in which is asked to the respondents if they knew what food additives are. To this question 84,5% answered yes, only 15,5% answered no. In chart 27 question 12 is set out in which is asked how they would describe food additives. Most of the respondents (48,9%) answered that they would describe it as an ingredient which is not naturally present in a food product. Other descriptions which are mentioned are: as something unfamiliar (1,6%), as an ingredient which is monitored by the government (6,8%), a functional ingredient that is added to food, something which is enhancing flavour but has a negative effect on health, added to improve the product, and 5,8% indicated that they didn't knew.

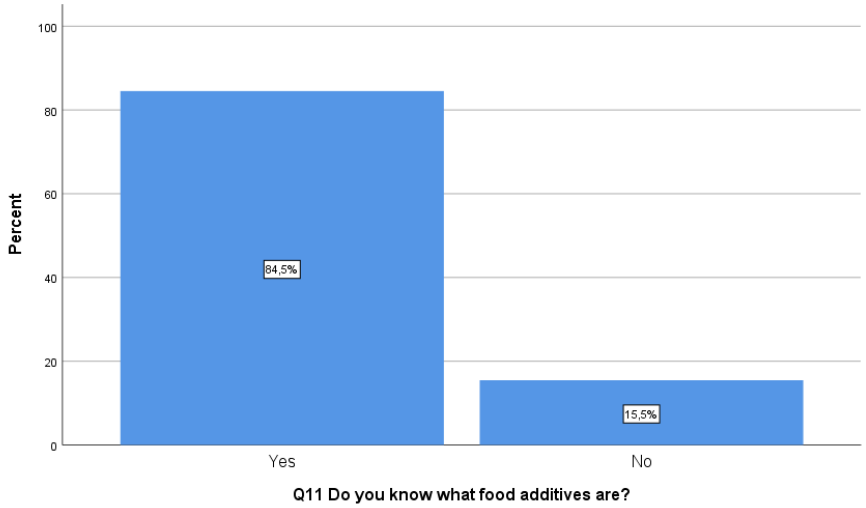

Chart 26: Q11 Do you know what food additives are?

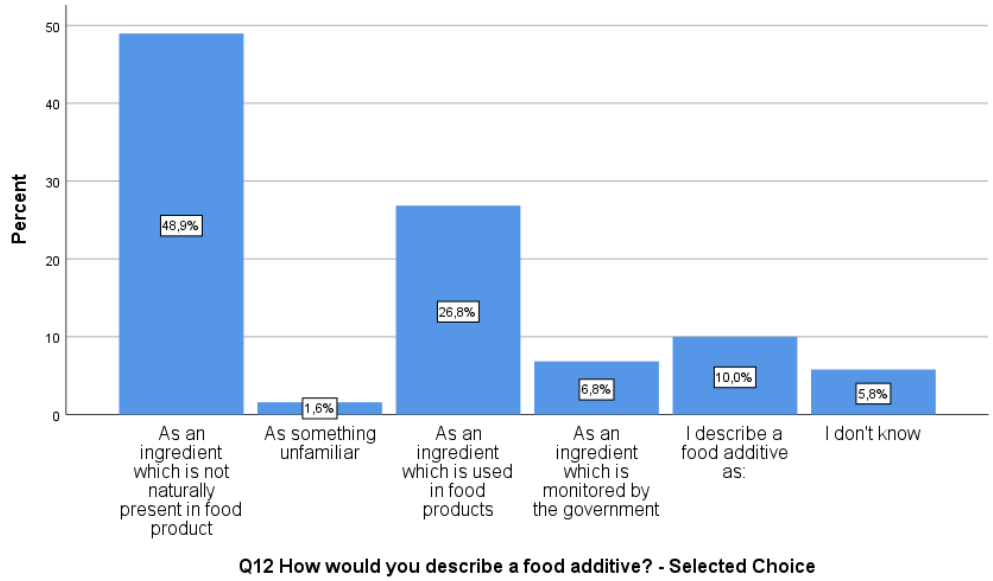

Chart 27: Q12 How would you describe a food additive?

Chart 28 sets out the answers of question 13 in which is asked to the respondents if they knew what E-numbers are. To this question 90,5% answered yes, only 9,5% answered no. In chart 29 question 14 is set out in which is asked how they would describe E-numbers. Most of the respondents (34,6%) answered that they would describe this as an ingredient which is monitored by the government. This is different compared to the answer to food additives which could indicate that consumers do not see E-numbers and food additives as the same. Other description given to E-numbers are: as an ingredient which is not naturally present in food products (17,3%), as something which could be dangerous to my health (1,0%), as something unfamiliar (0,5%), as an ingredient which is used in food products (21,5%), it is the same as a food additive, food additive which is approved by EU, code which is given to a food additive, improves products, number given to chemicals, and 6,8% indicated that they did not know.

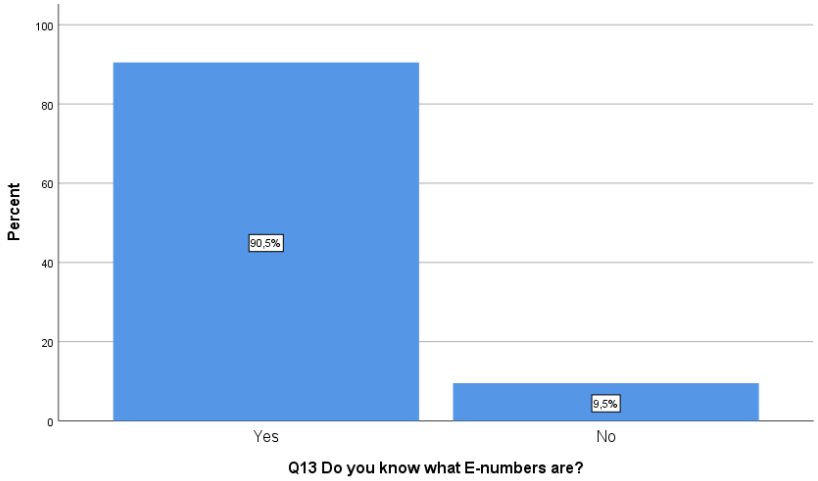

Chart 28: Q13 Do you know what E-numbers are?

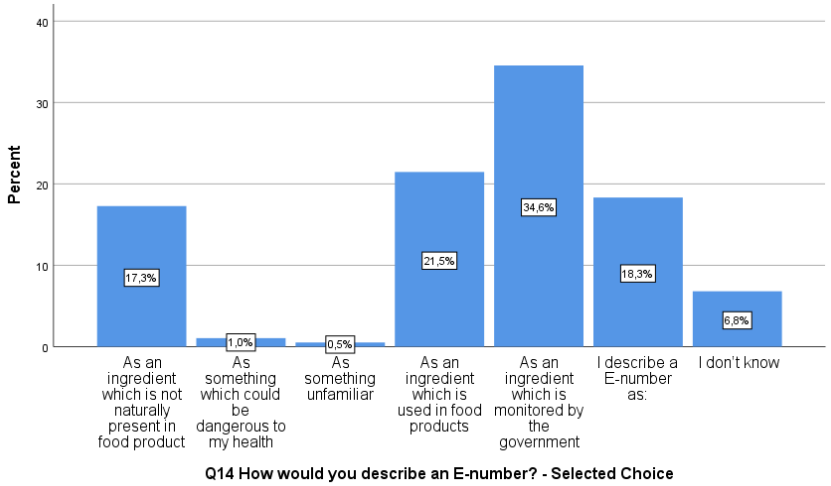

Chart 29: Q14 How would you describe an E-number?

Chart 30 indicates the results of question 25 in which is asked to the respondents which option they found most fitting for being clean label. Option A= ingredient list with only chemical names of E-numbers or option B= ingredient list without E-numbers (which represents a clean label ingredient list). Most of the respondents (54,8%) answered option B, 22,0% answered option A, 17,3% answered both option A and B, 1,8% answered none of these options, and 4,2% that they didn't knew.

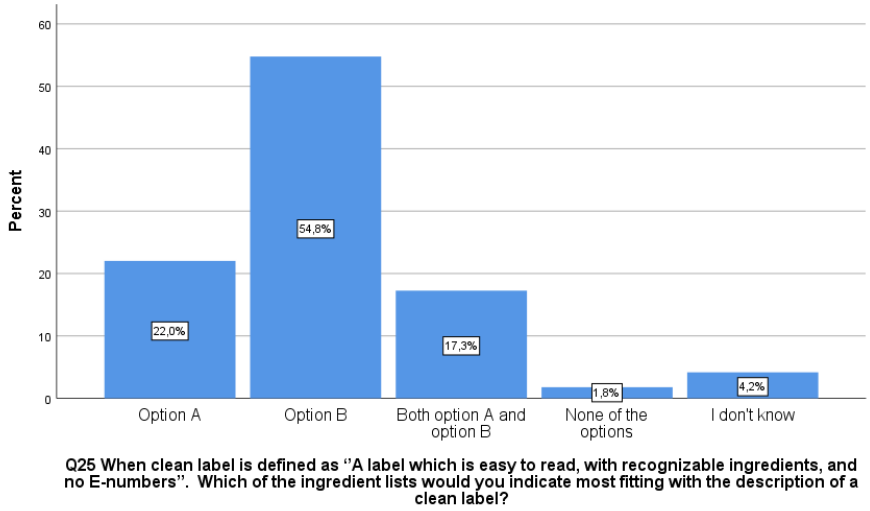

Chart 30: Q25 When clean label is defined as ''A label which is easy to read, with recognizable ingredients and no E-numbers''. Which of the ingredient lists would you indicate most fitting with the description of a clean label?

Chart 31 sets out the results of question 31 in which is asked which of the ingredient lists they preferred the most. Option A= ingredient list with only chemical names of E-numbers, option B= ingredient list without E-numbers (which represents a clean label ingredient list), option C= ingredient list with chemical names and E-numbers, and option D= ingredient list with E-numbers without the chemical names. Most of the respondents (35,1%) indicated that they preferred option B. The other respondents indicated that they preferred option A (21,4%), option C (29,2%), option D (6,5%), or that they had no preference (7,7%).

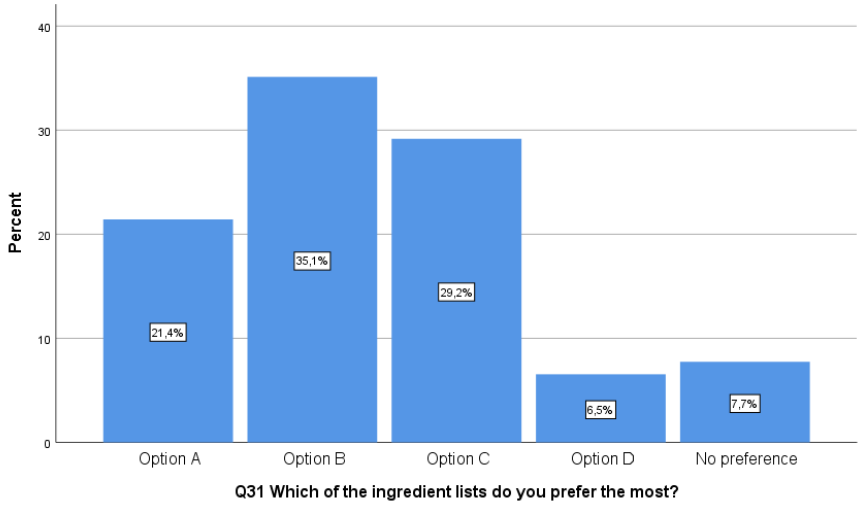

Chart 31: Q31 Which of the ingredient lists do you prefer the most?

Chart 32 sets out the answers to question 32 in which the respondents is asked why they prefer the option like indicated at question 31. Most of the respondents answered that they thought that this is the easiest to read option (44,0%). Other reasons which are mentioned are: I think it is the healthiest option (2,4%), I think it is the safest option (4,2%), I think it contains the most natural ingredients (5,4%), most information, most honest, not alarming, clearest, most detailed information, and most transparent.

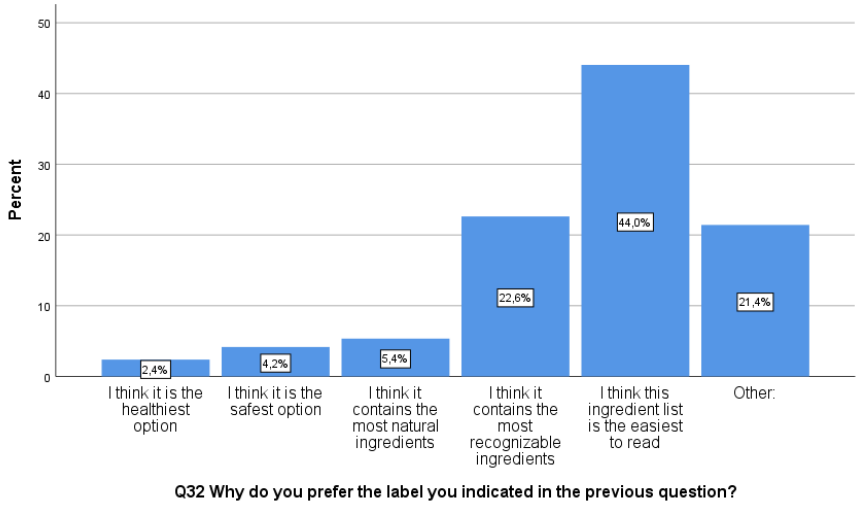

Chart 32: Q32 Why do you prefer the label you indicated in the previous question?

9. Conclusion

To answer the main-question: *Do consumers prefer clean labels, or labels which include E-numbers on their label, as it currently is regulated by the food law in Regulation (EC) No. 1333/2008 on food additives?,* a literature study and a questionnaire was carried out. In order to answer this question first the sub-questions will be answered.

The first sub-question which is answered is: *What is the aim of Regulation (EC) No. 1333/2008 on food additives?*. This question is answered in chapter 3 about the legislation on food additives. From this chapter it becomes clear that this Regulation aims to protect the human health and the consumer interests.

The second sub-question which is answered is: *How are the consumers interests towards food additives regulated by law?* This question in answered in chapter 3 about the legislation on food additives. Even though the view of the consumers towards food additives is not mentioned in Regulation 1333/2008 it should be taken into account to protect the consumers interest like is regulated in Regulation (EC) No. 178/2002 on general principles and requirements of food law and is aimed in Regulation 1333/2008. In article 4.2 of Regulation (EU) No. 1169/2011 on the provision of food information to consumers, it becomes clear that the consumers interests of the majority should be taken into account. The view of the consumers towards food additives take an important role to the interest of the consumer. Studies have indicated that consumers do not trust E-numbers and that they see this as something dangerous (Wandel, 1997). This interpretation of E-numbers by the consumer makes that it is not in their interest to use E-numbers on food labels. Therefore, the consumers interests regarding food additives and their indication at food labelling should be taken into account to amend Regulation 1333/2008.

The third sub question which is answered is: *What is already known about the knowledge and the view of consumers regarding E-numbers?*. This question is answered in the literature study and the questionnaire. The results of the questionnaire show that most of the respondents read the food labels which is in line with the results of the literature study. The questionnaire showed that most people knew what E-numbers and food additives are. This is not in line with the results of the literature study which shows that most consumers do not know what E-numbers and food additives are. The results of the questionnaire showed that most of the respondents thought that E-numbers are neither healthy nor unhealthy. This is not in line with the results of the literature study which showed that consumers think that food additives and E-numbers have a negative effect on your health (Al-Harthy et al., 2017 & Wandel, 1997). The literature study showed that consumers know that E-numbers are there to protect the human health, nevertheless, they do not believe that they can trust that the measures are effective (Tarnavölgyi, 2003). The results of the questionnaire show that natural achieved E-numbers are seen as acceptable more often compared to chemical achieved E-numbers. This is in line with the results of the literature study which also showed that natural achieved E-numbers are more preferred compared to chemical achieved E-numbers. Besides, the questionnaire shows that the respondents think E-numbers are safe but they also find E-numbers unrecognizable and difficult to read.

What is already known about the knowledge and the view of consumers regarding clean labels?. This question is answered by a literature study and the questionnaire. From the questionnaire it becomes clear that most respondents do not know what clean labels are. Most of the respondents did indicate clean labelling as a product which only consists out of recognizable ingredients. This meaning is found

in previous studies as well. The respondents were also asked which of the ingredient lists they found the most fitting to be a clean label. They could choose between an option with only the chemical names of E-numbers, an option without E-numbers, an option if they found both of the options being clean label, or none of the options. Most respondents found the option without the E-numbers the most fitting for being clean label.

In the questionnaire different statements were given to the respondents which they could answer by choosing an ingredient list. They could choose between an ingredient list with only the chemical names of E-numbers, a clean label ingredient list, an ingredient list with E-numbers and the chemical names, and an ingredient list with only the E-numbers. When looking at the answers of the respondents, it indicates that consumers perceive clean label ingredient lists as the most natural, safest, healthiest, easiest to read, and the most recognizable compared to the other ingredient lists between which the respondents had to choose. This indicates that the consumers view regarding clean labels is the most positive compared to the other options given.

The last sub-question which is answered is question: *How do consumers perceive clean labels compared to labels including E-numbers?.* This question is answered by the questionnaire and the literature study. There is no information found to compare this in previous studies. Previous studies do show that consumers prefer chemical names over E-numbers (Wandel, 1997). To compare how consumers perceive clean labels compared to labels including E-numbers the respondents of the questionnaire is asked if they would avoid unknown ingredients and E-numbers. The results show that unknown ingredients are more avoided compared to E-numbers. However, the respondents indicated different levels of how often they would do this and most of the respondents indicated that they never do this.

The results of the questionnaire show that consumers find clean label ingredient lists the safest, healthiest, most natural, easiest to read, and most recognizable option given. For this reason, it can be concluded that clean labels are perceived as more positive compared to the E-number including labels between which the respondents could choose.

To answer the main question: *Do consumers prefer clean labels, or labels which include E-numbers on their label, as it currently is regulated by the food law in Regulation (EC) No. 1333/2008 on food additives?,* it can be concluded that clean labels are the most preferred option when respondents could choose between an ingredient list with only the chemical names of E-numbers, an option without E-numbers, an option with both the chemical names and their E-numbers, or an option with only the E-numbers. From the results of the questionnaire it can be concluded that most respondents preferred clean label over ingredient lists with E-numbers even though this preference is variated. The most mentioned reason which they indicated to prefer the indicated option is because they found this the easiest to read option. An easy to read ingredient list is also indicated to be the second most important factor of a food product.

10. Discussion and recommendations

In order to answer the main question: *Do consumers prefer clean labels, or labels which include E-numbers on their label, as it currently is regulated by the food law in Regulation (EC) No. 1333/2008 on food additives?,* a questionnaire is used. This questionnaire is filled in by 212 respondents of which the answers of 167 respondents are analysed. The result of 45 respondents are not analysed because they did not live in the EU or because they did not completed the questionnaire. The 42 questionnaires which were not completed could be explained by the fact that this questionnaire was distributed during a break of the course Food Law at the Wageningen University. Respondents could have started the questionnaire but might not have enough time to complete the questionnaire during the break.

Most of the respondents of the questionnaire are female and have an age between 21-30 years. Furthermore, most of the respondents have a higher education and live in the Netherland. This can be explained by the fact that this questionnaire is distributed in the Netherlands during the course Food law at Wageningen University and the social media account of a Dutch student with an higher education and a age between 21-30 years. Besides, many of the respondents of this study were having a background for which they knew what E-numbers are. This can be explained by the way in which the questionnaire is distributed as well. It is presumable that this could be the reason that demographics characteristics of the respondents are not being equally varied as the average European citizen. Consequently, the results of this study might not give a good reflection of the general resident of the EU. It would be recommended to carry out this study again among a more average group of respondents comparable to the average European citizen. It would be recommended to use respondents from different countries in the EU with a varied gender, age, education level, and background, comparable with the average European citizen.

The knowledge and view of E-numbers presents different results in the literature study compared to the results of the questionnaire. This can be explained by the background of most respondents wherefore they already knew what E-numbers are. For this reason, it is recommended to carry out this study again among a group of people without a background wherefore they know what E-numbers are.

From the result of the questionnaire it can be concluded that most respondents preferred the clean label ingredient list. This can be explained by the fact that most respondents had a higher education and might have a higher interest in food additives because of their background wherefore they knew what E-numbers are. A previous study already showed that these groups preferred labels with chemical names. For this reason, the result that most respondents preferred clean labels in this study could be explained by their background and education level. Furthermore, a previous study showed that consumers prefer labels which are additive free and contain familiar ingredients. Even though the results of this study show that most of the respondents do not avoid additives or E-numbers, it is indicated that the respondents preferred an easy to read ingredient list. This could also explain the preference for clean labels which is found in this study.

The result of this study shows that a majority of the respondents preferred clean labels over E-number including labels. Besides, E-numbers are seen as unclear and difficult to understand. Therefore, it is concluded that E-numbers are not in the interest of the consumers and clean labels are preferred more often. As a result, Regulation 1333/2008 is not reaching the aim to take the consumers interest into account which it should according to article 8 (1) of Regulation (EC) No. 178/2002 on general principles

and requirements of food law. Therefore, it is advised to the policy makers that Regulation 1333/2008 should be evaluated and revised. When amending this Regulation the consumers interest of the majority should be taken into account like set in article 4 (2) of Regulation (EU) No. 1169/2011 on the provision of food information. Therefore, the result of this study which shows that a majority of the respondents preferred clean labels and found these the most natural, safest, healthiest, easiest to read, and the most recognizable should be taken into account. To reach the aim to protect the interest of consumers it is advised to implement a new or improved system of indicating food additives which guarantees the safety of the consumer in a way in which the consumers would prefer to receive food information. When using this study it should be considered that the questionnaire of this study does not reflect the average European citizen and more research is needed to confirm the results of this study.

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Appendix 1 Questionnaire Dutch

Dank u welt dat u mij wil helpen met mijn Master thesis door deze enquête in te vullen. Deze enquête gaat over voedingsmiddelen en de bijbehorende etiketten. Deze enquête bestaat uit 36 vragen. Het beantwoorden van deze vragen zal ongeveer 10 minuten duren. Uw deelname aan deze enquête is volledig anoniem. Uw antwoorden zullen vertrouwelijk behandeld worden volgens de privacy wetgeving en zullen alleen voor dit onderzoek gebruikt worden. Wanneer u nog vragen heeft over deze enquête of het onderzoek, dan kunt u contact opnemen met Alida via het volgende email adres: alida.meijer@wur.nl. Alvast bedankt voor het invullen van deze enquête!

1. Heeft u bovenstaande tekst gelezen?
   - Ja
   - Nee
   Wanneer nee, word er een melding zichtbaar met: Lees eerst de bovenstaande tekst voor dat u verder gaat.

2. Woont u op dit moment in de Europese Unie?
   - Ja
   - Nee
   Bij Nee naar einde van de enquête

3. Geef aan in hoeverre u het eens bent met de volgende stelling: Ik lees de etiketten van voedingsmiddelen.
   - Nooit
   - Soms
   - De helft van de keren
   - Meestal
   - Altijd

4. Geef aan in hoeverre u het eens bent met de volgende stelling: Ik kijk naar de lijst van ingrediënten van voedingsmiddelen.
   - Nooit
   - Soms
   - De helft van de keren
   - Meestal
   - Altijd

5. Geef aan in hoeverre u het eens bent met de volgende stelling: Ik vermijd het kopen van voedingsmiddel die voor mij onbekende ingrediënten bevat.
   - Nooit
   - Soms
   - De helft van de keren
   - Meestal
   - Altijd

6. Wanneer natuurlijk is beschreven als ‘’gemaakt door de natuur en niet door mensen’’. In hoeverre vind u het belangrijk dat een product alleen natuurlijke ingrediënten bevat?
   (1= niet belangrijk 5= wel belangrijk)

7. Wanneer gezondheid is beschreven als ‘’de psychologische en mentale conditie’’. In hoeverre vind u het belangrijk dat de ingrediënten van een voedingsmiddel bijdragen aan uw gezondheid?
   (1= niet belangrijk 5= wel belangrijk)

8. Wanneer veiligheid is beschreven als ‘’niet blootgesteld aan risico of gevaar’’. In hoeverre vind u het belangrijk dat voedingsmiddelen veilig zijn?
   (1= niet belangrijk 5= wel belangrijk)

9. Hoeverre vind u het belangrijk dat een ingrediëntenlijst makkelijk te lezen is?
   (1= niet belangrijk 5= wel belangrijk)

10. Hoeverre vind u het belangrijk dat een ingrediëntenlijst herkenbare ingrediënten bevat?
    (1= niet belangrijk 5= wel belangrijk)

11. Weet u wat voedingsadditieven zijn?
    -Ja
    - Nee

12. Hoe zou u voedingsadditieven omschrijven?
    - Als een ingrediënt die niet van nature in het product zit
    - Als iets wat gevaarlijk zou kunnen zijn voor mijn gezondheid
    - Als iets onbekends
    - Als een ingrediënt die gebruikt word in voedingsmiddelen
    - Als een ingrediënt die word gecontroleerd door de overheid
    - Ik zou een voedingsadditief omschrijven als:
    - Weet ik niet

13. Weet u wat E-nummers zijn?
    -Ja
    - Nee

14. Hoe zou u E-nummers omschrijven?

    - Als een ingrediënt die niet van nature in het product zit
    - Als iets wat gevaarlijk zou kunnen zijn voor mijn gezondheid
    - Als iets onbekends
    - Als een ingrediënt die gebruikt word in voedingsmiddelen
    - Als een ingrediënt die word gecontroleerd door de overheid
    - Ik zou een voedingsadditief omschrijven als:
    - Weet ik niet

    E-nummers zijn nummers die door de Europese Unie gegeven zijn aan voedingsadditieven/ingrediënten. Deze E-nummers zijn te vinden op het etiket van voedingsmiddelen.

15. Geef aan in hoeverre u het eens bent met de volgende stelling: Ik lees de E-nummers wanneer ik de ingrediëntenlijst lees.
    - Nooit

- Soms
- De helft van de keren
- Meestal
- Altijd

16. Geef aan in hoeverre u het eens bent met de volgende stelling: Ik vermijd producten die E-nummers bevatten.
    - Nooit
    - Soms
    - De helft van de keren
    - Meestal
    - Altijd

17. Wanneer gezondheid is beschreven als ‘’de psychologische en mentale conditie’’. In hoeverre denkt u dat E-nummers gezond zijn?
    - Ongezond
    - Enigszins ongezond
    - Niet ongezond en niet gezond
    - Enigszins gezond
    - Gezond
    - Weet ik niet

18. Wanneer veiligheid is beschreven als ‘’niet blootgesteld aan risico of gevaar’’. In hoeverre denkt u dat E-nummers veilig zijn?
    - Onveilig
    - Enigszins onveilig
    - Niet onveilig en niet veilig
    - Enigszins veilig
    - Veilig
    - Weet ik niet

19. Geef aan in hoeverre **chemisch ontwikkelde** E-nummers (gemaakt door mensen) een door u geaccepteerde toevoeging zijn aan voedingsmiddelen.
    - Ongeaccepteerd
    - Enigszins ongeaccepteerd
    - Niet geaccepteerd en niet ongeaccepteerd
    - Engiszins geaccepteerd
    - Geaccepteerd
    - Weet ik niet

20. Geef aan in hoeverre **natuurlijke** E-nummers (van natuurlijke bron) een door u geaccepteerde toevoeging zijn aan voedingsmiddelen.
    - Ongeaccepteerd
    - Enigszins ongeaccepteerd
    - Niet geaccepteerd en niet ongeaccepteerd
    - Engiszins geaccepteerd

- Geaccepteerd
- Weet ik niet

21. Geef aan in hoeverre u vind dat het systeem van E-nummers het makkelijker maakt om ingrediënten lijsten te lezen.
    - Moeilijk
    - Enigszins moeilijk
    - Niet moeilijk en niet makkelijk
    - Enigszins makkelijk
    - Makkelijk
    - Weet ik niet

22. Geef aan in hoeverre u vind dat het systeem van E-nummers een herkenbare manier is om ingrediënten te benoemen.
    - Onherkenbaar
    - Enigszins onherkenbaar
    - Niet Onherkenbaar maar ook niet herkenbaar
    - Enigszins herkenbaar
    - Herkenbaar
    - Weet ik niet

23. Kent u het concept van clean labelen?
    - Ja
    - Nee

24. Hoe zou u het concept van clean labelen beschrijven?
    - Als iets wat gevaarlijk kan zijn voor mijn gezondheid
    - Als iets onbekends
    - Als een product wat alleen herkenbare ingrediënten bevat
    - Als een product zonder E-nummers
    - Als een product die alleen natuurlijke ingrediënten bevat
    - Ik beschrijf clean label als:
    - Weet ik niet

25. Wanneer clean label word beschreven als ‘’Een etiket die makkelijk leesbaar is, met herkenbare ingrediënten en geen E-nummers’’. Welk van de volgende ingrediënten lijsten zou u het beste binnen de beschrijving van clean labels vinden passen?

Optie A

Halfvolle vruchten yoghurt

Ingrediënten:
Halfvolle yoghurt, water, 3% aardbei, suiker, 2% aardbeipuree uit concentraat, verdikkingsmiddel (guarpitmeel, pectine), zuurteregelaar (citroenzuur, calciumcitraat), kleurend concentraat (wortel, appelbes, druif), gemodificeerd maïszetmeel, glucose-fructosestroop, aroma

Optie B

Halfvolle vruchten yoghurt

Ingrediënten:
Halfvolle yoghurt, water, 3% aardbei, suiker, 2% aardbeipuree uit concentraat, maïszetmeel, rijst zetmeel, wortel concentraat, appel concentraat, rode bieten concentraat, rode druif concentraat, glucose-fructosestroop, aroma

- Optie A
- Optie B
- Optie A en B
- Geen van deze opties
- Weet ik niet

26. Wanneer gezondheid is beschreven als ‘’de psychologische en mentale conditie’’. Welke van de combinaties van ingrediënten in de verschillende ingrediëntenlijsten vind u het beste voor uw gezondheid?

Optie A

Halfvolle vruchten yoghurt

Ingrediënten:
Halfvolle yoghurt, water, 3% aardbei, suiker, 2% aardbeipuree uit concentraat, verdikkingsmiddel (guarpitmeel, pectine), zuurteregelaar (citroenzuur, calciumcitraat), kleurend concentraat (wortel, appelbes, druif), gemodificeerd maïszetmeel, glucose-fructosestroop, aroma

Optie B

Halfvolle vruchten yoghurt

Ingrediënten:
Halfvolle yoghurt, water, 3% aardbei, suiker, 2% aardbeipuree uit concentraat, maïszetmeel, rijst zetmeel, wortel concentraat, appel concentraat, rode bieten concentraat, rode druif concentraat, glucose-fructosestroop, aroma

Optie C

Halfvolle vruchten yoghurt

Ingrediënten:
Halfvolle yoghurt, water, 3% aardbei, suiker 2% aardbeipuree uit concentraat, verdikkingsmiddel (guarpitmeel E412, pectine E440), zuurteregelaar (citroenzuur E330, calciumcitraat E333), kleurend concentraat (wortel, appelbes, druif), gemodificeerd maïszetmeel, glucose-fructosestroop, aroma

Optie D

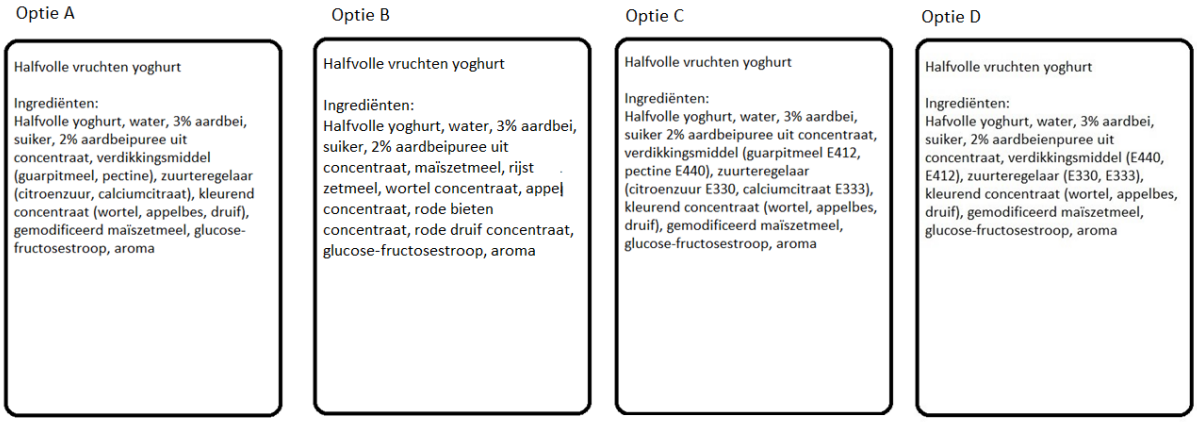
Halfvolle vruchten yoghurt

Ingrediënten:
Hafvolle yoghurt, water, 3% aardbei, suiker, 2% aardbeienpuree uit concentraat, verdikkingsmiddel (E440, E412), zuurteregelaar (E330, E333), kleurend concentraat (wortel, appelbes, druif), gemodificeerd maïszetmeel, glucose-fructosestroop, aroma

- Optie A
- Optie B
- Optie C
- Optie D

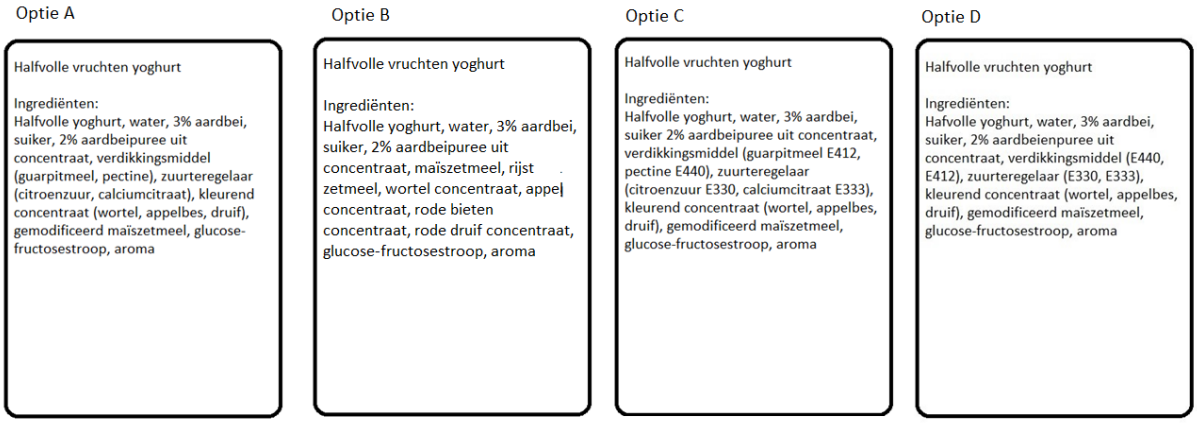
- Ik denk dat geen van de bovenstaande combinaties van ingrediënten goed zijn voor je gezondheid.
- Weet ik niet

27. Wanneer veiligheid is beschreven als ‘’niet blootgesteld aan risico of gevaar’’. Welke van de volgende combinaties van ingrediënten in de verschillende ingrediëntenlijsten vind u het veiligste?



- Optie A
- Optie B
- Optie C
- Optie D
- Ik denk dat geen van de bovenstaande combinaties van ingrediënten veilig zijn.
- Weet ik niet

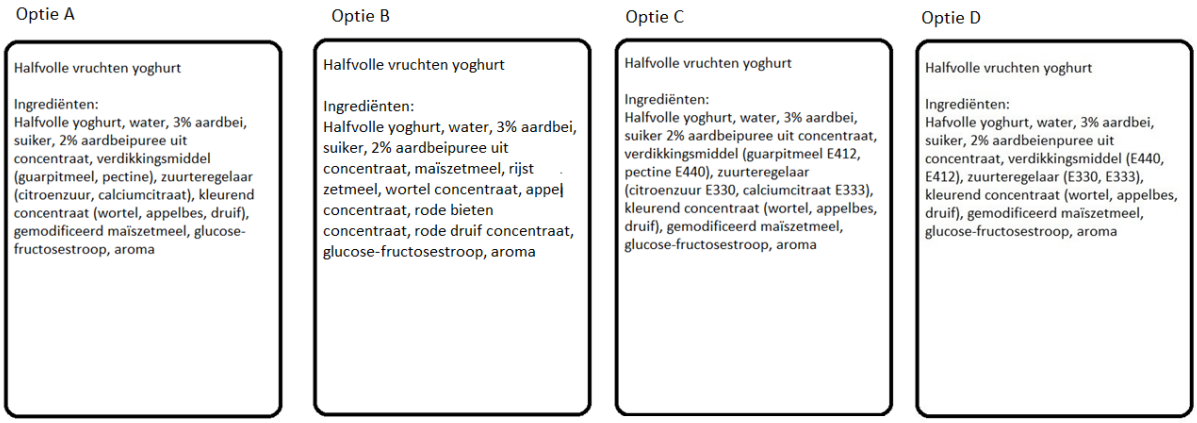
28. Wanneer natuurlijk is beschreven als ‘’gemaakt door de natuur en niet door mensen’’. Welke van de combinaties van ingrediënten in de verschillende ingrediëntenlijsten vind u het meest natuurlijk?



- Optie A
- Optie B

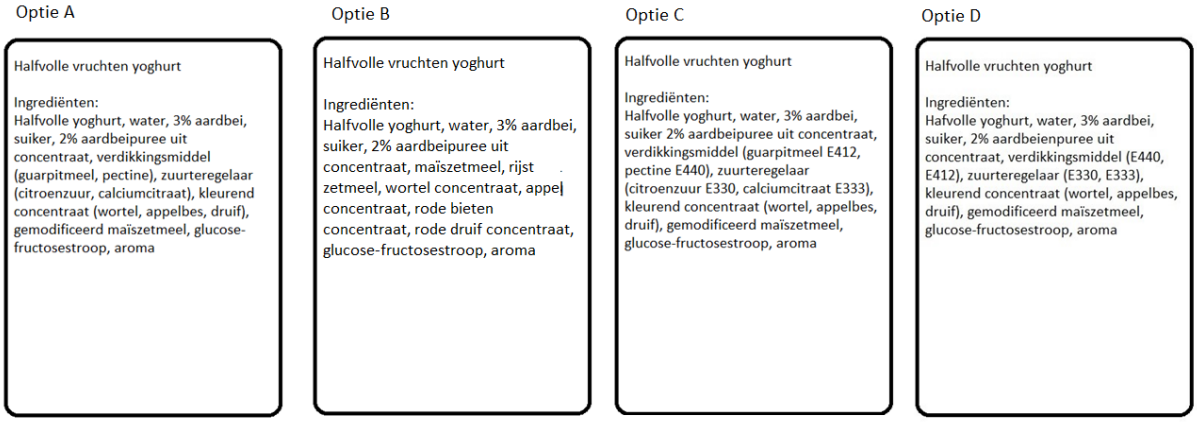
- Optie C
- Optie D
- Ik denk dat geen van de bovenstaande combinaties van ingrediënten natuurlijk zijn.
- Weet ik niet

29. Welke van de ingrediëntenlijsten vind u het makkelijkst leesbaar?



- Optie A
- Optie B
- Optie C
- Optie D
- Ik vind alle opties moeilijk om te lezen
- Weet ik niet

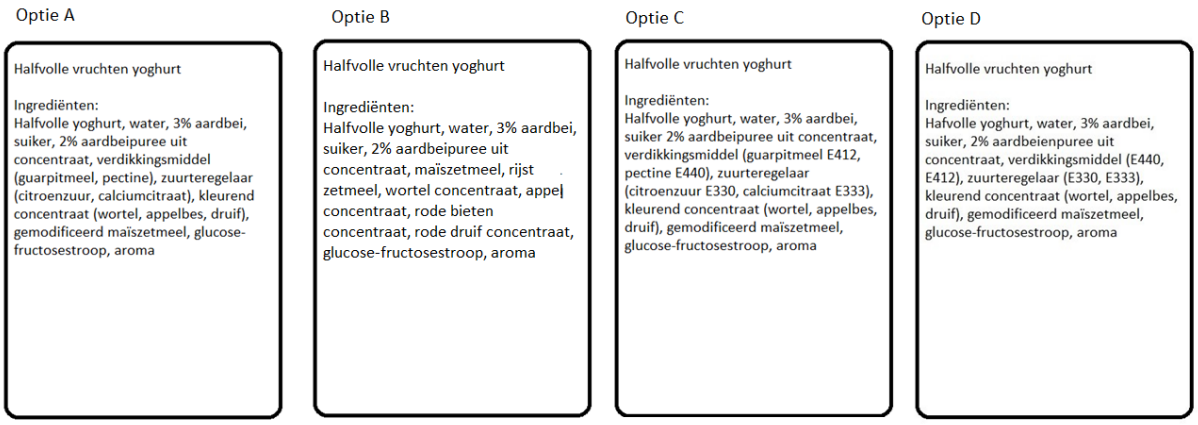
30. Welke van de ingrediëntenlijsten vind u het meest herkenbaar?



- Optie A
- Optie B
- Optie C
- Optie D

- Ik vind geen van deze opties herkenbaar
- Weet ik niet

31. Welke optie van de ingrediëntenlijsten heeft uw voorkeur?



- Optie A
- Optie B
- Optie C
- Optie D
- Geen voorkeur

32. Waarom heeft het etiket zoals in de vorige vraag beantwoord, uw voorkeur?

- Ik denk dat dit de gezondste optie is
- Ik denk dat dit de veiligste optie is
- Ik denk dat dit de meest natuurlijke ingrediënten bevat
- Ik denk dat dit de meest herkenbare ingrediënten bevat
- Ik denk dat dit de meest makkelijk te lezen optie is
- Anders namelijk:

Beantwoord nu de volgende algemene vragen.

33. Wat is uw geslacht?
- Man
- Vrouw
- Ik beantwoord deze vraag liever niet

34. Wat is uw leeftijd?
-20 jaar of jonger
-21-30

-31-40
-41-50
-51-60
-61-70
-71-80
-81 jaar of ouder
- Ik beantwoord deze vraag liever niet

35. Wat is uw hoogst afgeronde school?
- basisonderwijs
- voortgezet onderwijs (VMBO, HAVO, VWO)
- middelbaar beroepsonderwijs (MBO)
- hoger onderwijs (HBO, Universitair onderwijs)
- anders
- Ik beantwoord deze vraag liever niet

36. Heeft u een achtergrond (bijvoorbeeld door uw studie) waardoor u al wist wat E-nummers zijn?
- Ja
- Nee

37. In welk land woont u op dit moment?
België
Bulgarije
Zuid-Cyprus
Denemarken
Duitsland
Estland
Finland
Frankrijk
Griekenland
Hongarije
Ierland
Italië
Kroatië
Letland
Litouwen
Luxemburg
Malta
Nederland
Oostenrijk
Polen
Portugal
Roemenië
Slovenië
Slowakije

Spanje
Tsjechië
Verenigd Koninkrijk
Zweden
Een niet EU land
Ik beantwoord deze vraag liever niet

38. Is het land waar u woont het zelfde als waar u geboren bent?
    - Ja
    - Nee, mijn geboorte land is:
    - Ik beantwoord deze vraag liever niet

    Dank u wel voor het invullen van deze enquête!

https://wur.az1.qualtrics.com/jfe/form/SV_bpVDZzywNHvFJLT

Appendix 2 Questionnaire English

Thank you for helping me with my Master thesis by filling in this questionnaire. The subject of this questionnaire is about food products and their labels. This questionnaire has 36 questions. Answering this questionnaire will take approximately 10 minutes. Your participation in this study is completely anonymous. Your answers will be treated confidentially according to the standard of the privacy law and will only be used for this research. If you have any questions about this questionnaire or the research, you can contact Alida by sending an email at alida.meijer@wur.nl. Thank you in advance for filling in this questionnaire.

1. Did you read the text above?
   - Yes
   - No

   If no send to message: please read the above text before you continue
2. Do you currently live in an European country?
   - Yes
   - No

   If no respondent will be send to the end of the survey
3. To what extend do you agree with the following statement: I read the labels of food products.
   - Never
   - Sometimes
   - About half of the time
   - Most of the time
   - Always
4. To what extend do you agree with the following statement: I look at the ingredient lists of food products.
   - Never
   - Sometimes
   - About half of the time
   - Most of the time
   - Always
5. To what extend do you agree with the following statement: I avoid buying food product if they contain ingredients which are unknown for me.
   - Never
   - Sometimes
   - About half of the time
   - Most of the time
   - Always

6. When natural is described as ‘’made by nature and not by human kind’’. To what extend do you find it important that a product only contains natural ingredients?
   (1= not important 5= very important)
7. When health is defined as ‘’The physical and mental condition’’. To what extend do you find it important that the ingredients of a food product are beneficial to your health?
   (1= not important 5= very important)
8. When safety is defined as ‘’not exposed to danger or risk’’. To what extend do you find it important that a food product is safe?
   (1= not important 5= very important)
9. To what extend do you find it important that an ingredient list is easy to read?
   (1= not important 5= very important)
10. To what extend do you find it important that an ingredient list contains recognizable ingredients?
    (1= not important 5= very important)
11. Do you know what food additives are?
    -Yes
    -No
12. How would you describe a food additive?
    - As an ingredient which is not naturally present in food product
    - As something which dangerous to my health
    - As something unfamiliar
    - As an ingredient which is used in food products
    - As an ingredient which is monitored by the government
    - I describe a food additive as:
    - I don’t know
13. Do you know what E-numbers are?
    - Yes
    - No
14. How would you describe an E-number?
    - As an ingredient which is not naturally present in food product
    - As something which could be dangerous to my health
    - As something unfamiliar
    - As an ingredient which is used in food products
    - As an ingredient which is monitored by the government

- I describe an E-number as:
- I don’t know

E-numbers are the numbers given by the European Union to a food additive/ingredient. You can find these E-numbers in the ingredient list on the food label of the product.

15. To what extend do you agree with the following statement: I look at the E-numbers when reading an ingredient list.
    - Never
    - Sometimes
    - About half of the time
    - Most of the time
    - Always
16. To what extend do you agree with the following statement: I avoid products which contain E-numbers.
    - Never
    - Sometimes
    - About half of the time
    - Most of the time
    - Always
17. When health is defined as ‘’The physical and mental condition’’. To what extend do you think E-numbers healthy?
    - Unhealthy
    - Somewhat unhealthy
    - Neither healthy nor unhealthy
    - Somewhat healthy
    - Healthy
    - I don’t know
18. When safety is defined as ‘’not exposed to danger or risk’’. To what extend do you think E-numbers are an safe?
    - Unsafe
    - Somewhat unsafe
    - Neither safe nor unsafe
    - Somewhat safe
    - Safe
    - I don’t know
19. To what extend do you think **chemically achieved** E-number (made by humans) are an acceptable addition to food products?
    - Unacceptable
    - Somewhat unacceptable
    - Neither acceptable nor unacceptable
    - Somewhat acceptable

- Acceptable
- I don’t know

20. To what extend do you think **naturally achieved** E-numbers (from a natural source) are an acceptable addition to food products?
    - Unacceptable
    - Somewhat unacceptable
    - Neither acceptable nor unacceptable
    - Somewhat acceptable
    - Acceptable
    - I don’t know

21. To what extend do you find the system of E-numbers making it easier to read the ingredient list?
    - Difficult
    - Somewhat difficult
    - Neither difficult nor easy
    - Somewhat easy
    - Easy
    - I don’t know

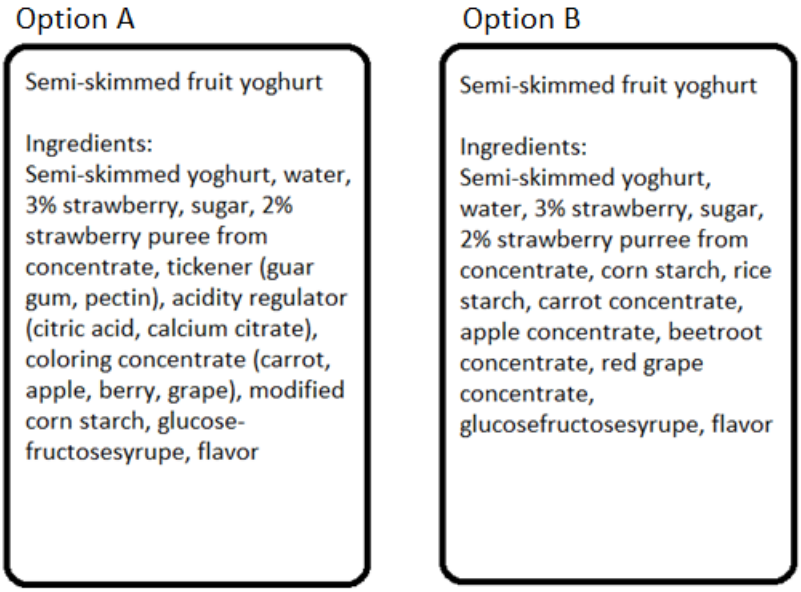
22. To what extend do you find the system of E-numbers a recognizable way of indicating an ingredient?
    - Unrecognizable
    - Somewhat unrecognizable
    - Neither unrecognizable nor recognizable
    - Somewhat recognizable
    - Recognizable
    - I don’t know

23. Do you know the concept of clean labelling?
    - Yes
    - No

24. How would you describe the concept of clean labelling?

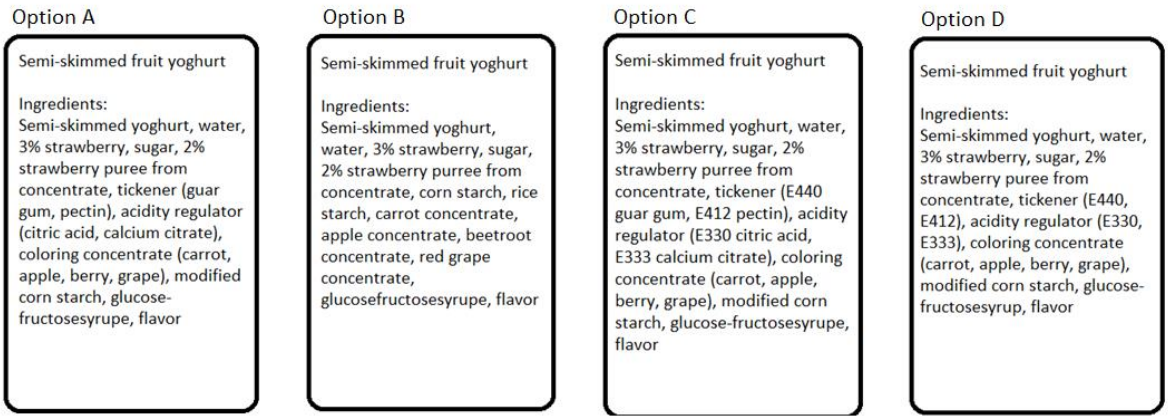
    - As something which could be dangerous to my health
    - As something unfamiliar
    - As a product which only consists out of recognizable ingredients
    - As a product with no E-numbers
    - Aa a product which only consists ingredients which are naturally
    - I describe clean label as:
    - I don’t know

25. When clean label is defined as ''A label which is easy to read, with recognizable ingredients, and no E-numbers''. Which of the ingredient lists would you indicate most fitting with the description of a clean label?



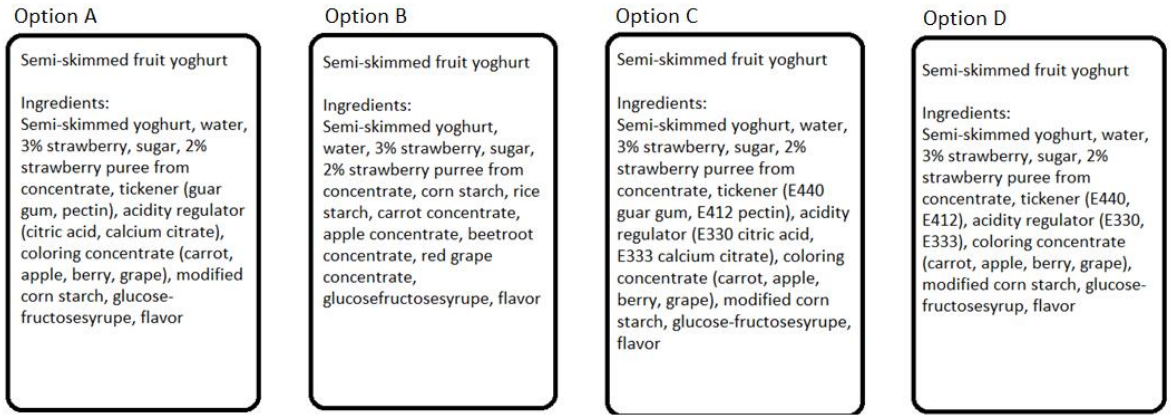
- Option A
- Option B
- Both option A and option B
- None of the options
- I don't know

26. When health is defined as ''The physical and mental condition''. Which of the combinations of ingredients in the different ingredient lists do you find the most beneficial for your health?



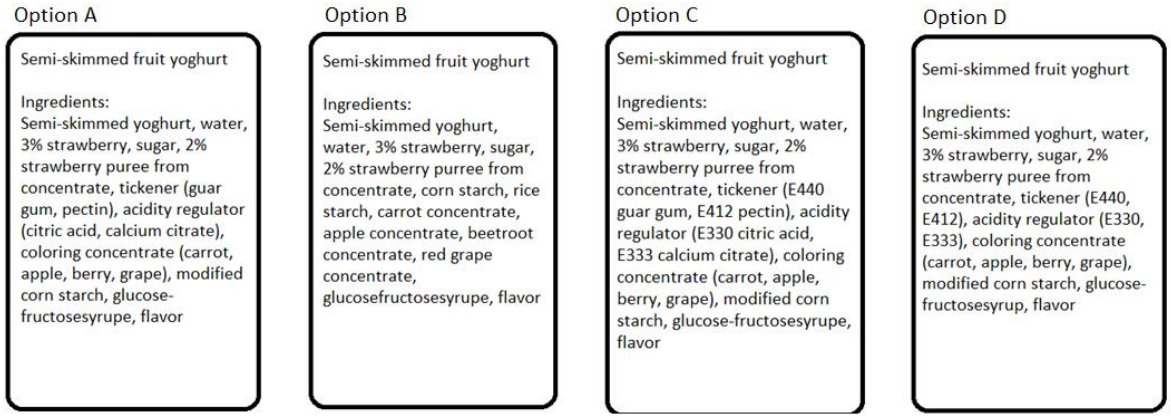
- Option A
- Option B
- Option C
- Option D
- I think that none of the above combinations of ingredients are beneficial for your health
- I don't know

27. When safety is defined as ''not exposed to danger or risk''. Which of the combinations of ingredients in the different ingredient lists do you find the safest?



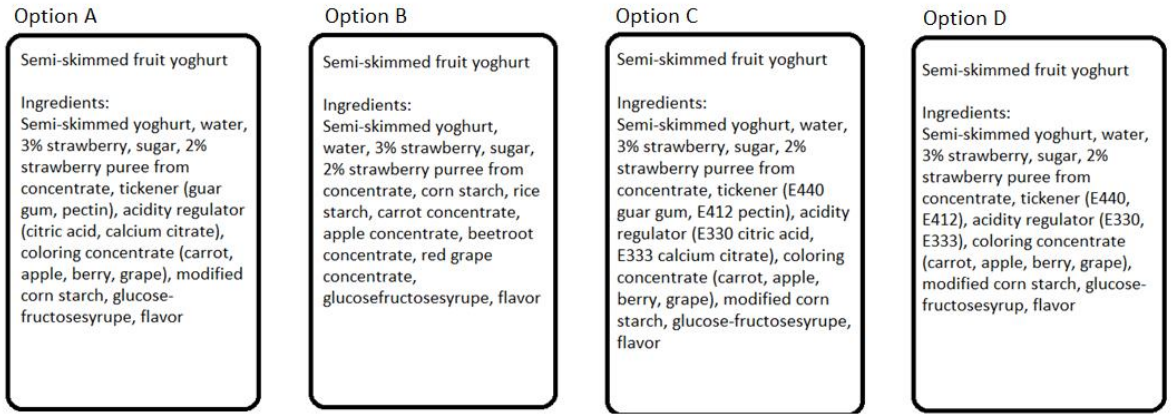
- Option A
- Option B
- Option C
- Option D
- I think that none of the above combinations of ingredients are safe
- I don't know

28. When natural is defined as ''made by nature and not by human kind''. Which of the combinations of ingredients in the different ingredient lists do you find the most natural?



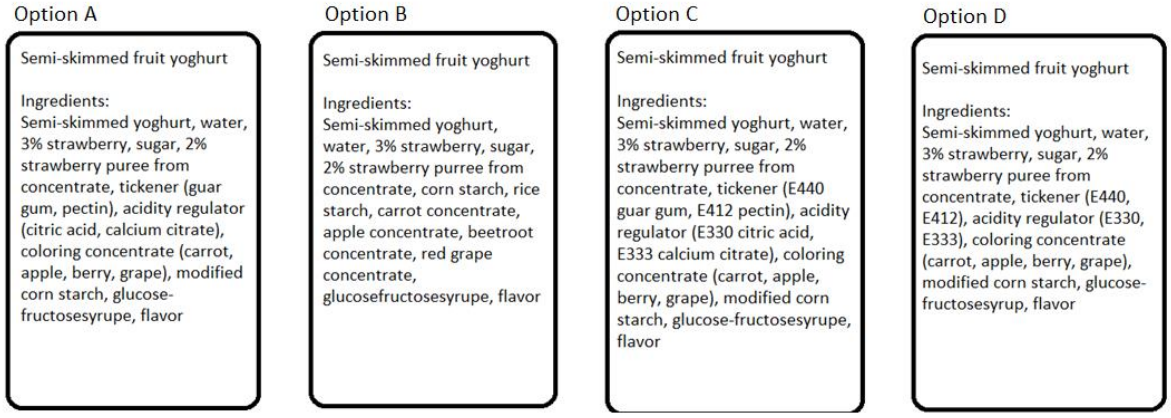
- Option A
- Option B
- Option C
- Option D
- I think that none of the above combinations of ingredients are natural
- I don't know

29. Which of the ingredient lists do you find the easiest to read?



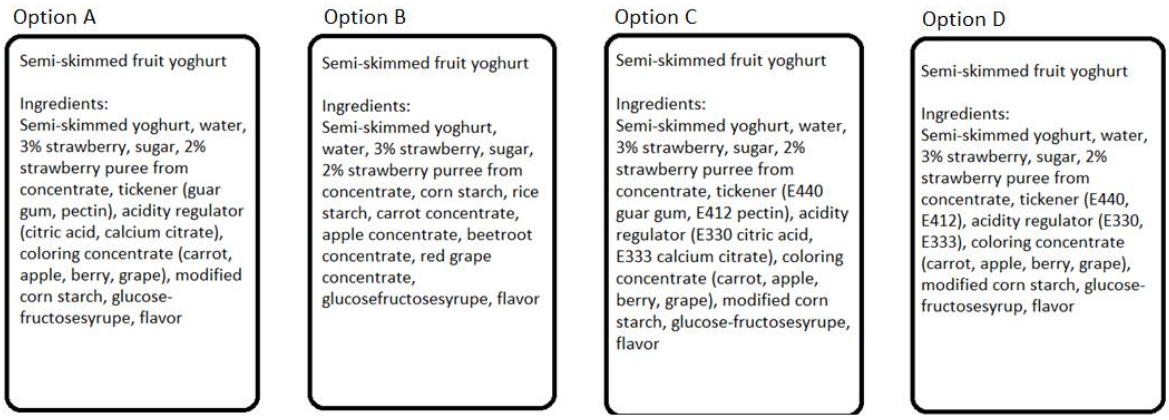
- Option A
- Option B
- Option C
- Option D
- I think that all options are difficult to read
- I don’t know

30. Which way of indicating the ingredients in the ingredient list do you find the most recogniza-ble?



- Option A
- Option B
- Option C
- Option D
- I find none of these ways of indicating the ingredients recognizable
- I don’t know

31. Which of the ingredient list do you prefer the most?



- Option A
- Option B
- Option C
- Option D
- No preference

32. Why do you prefer the label you indicated in the previous question?
    - I think it is the healthiest option
    - I think it is the safest option
    - I think it contains the most natural ingredients
    - I think it contains the most recognizable ingredients
    - I think this ingredient list is the easiest to read
    - Other:

    Please answer the next general questions

33. What is your gender?
    - Male
    - Female
    - I would rather not answer this question

34. What is your age?
    - 20 years or younger
    -21-30
    -31-40
    -41-50
    -51-60
    -61-70
    -71-80
    -81 years or older
    - I would rather not answer this question

35. What is your highest completed education?
    - primary education
    - secondary education
    - secondary vocational education
    - higher education (higher vocational education, university education)
    - other
    - I would rather not answer this question

36. Do you have a background (for example because of your studies) wherefore you already knew what E-numbers are?
    - Yes
    - No

37. In which country do you currently live?
    Belgium
    Bulgaria
    Croatia
    Cyprus
    Denmark
    Germany
    Estonia
    Finland
    France
    Greece
    United Kingdom
    Hungary
    Ireland
    Italy
    Latvia
    Lithuania
    Luxembourg
    Malta
    The Netherlands
    Austria
    Poland
    Portugal
    Romania
    Slovenia
    Slovakia
    Spain
    Czech Republic
    Sweden
    Not EU country
    I would rather not answer this question

38. Is the country you're living in the same as your country of origin?
    - Yes

- No, my country of origin is:
- I would rather not answer this question

Thank you for filling in this questionnaire!

https://wur.az1.qualtrics.com/jfe/form/SV_6yU3BPyPT8Ck7Mp