The consumer perception and intent behaviour regarding lactose-free and gluten-free claims and possible legal implications

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Abstract

In recent years, sales of lactose-free and gluten-free products has increased, and factors other than an increase in lactose and gluten intolerance are probably responsible for that development. This study aims to investigate what the consumer perception and intent behaviour are regarding gluten-free and lactose-free claims and if this could have legal implications. A literature review and online survey were conducted to achieve this aim. Three types of lactose-free and gluten-free claims were investigated, namely symbols, textual claims, and symbols including text. In the experiment, participants were presented with images of lactose-free and gluten-free claims and products with those claims and asked to evaluate the meaning, product characteristics, likeliness to buy, and the lactose or gluten content of the product. Results show that the type of claim influences the percentage of good definitions for lactose-free and gluten-free. Products with and without lactose-free or gluten-free claims were perceived as having the same product characteristics. Furthermore, people significantly are more likely to buy products without lactose-free and gluten-free claims compared to those products with such claims. Besides, the perceived amount of lactose and gluten in a lactose-free or gluten-free product is significantly different from the amount that is allowed in such product. The results from this research may be used as evidence to show that lactose-free and gluten-free claims are possibly misleading, ambiguous, confusing, not clear, and not easy to understand for the consumer. This can result in some legal implications. Possible solutions are discussed for improvements of the current legislation applicable to lactose-free and gluten-free claims at European level.

Key words: *gluten-free, lactose-free, claims, EU law, perception, intent behaviour, consumer protection*

Table of Contents

List of Abbreviations

CJEU	Court of Justice of the European Union
EU	European Union
FIR	Food Information to Consumer Regulation
PAL	Precautionary Allergen Labelling
SPSS	Statistical Package for the Social Sciences
UCPD	Unfair Commercial Practices Directive
WUR	Wageningen University and Research

1. Introduction

1.1 Problem statement

Approximately 20% of the population alters their diet for a perceived adverse reaction to food. The adverse reaction to food can be caused by an adverse immune response to a food protein, a host-specific metabolic disorder, a pharmacologically active or toxic food component, or a nonreproducible adverse reaction. (Sicherer and Sampson, 2006)

A food allergy is an example of an adverse immune response to a food protein. Food allergic reactions are immediate and are mediated by IgE antibodies (Buttriss, 2008). In some Western countries, the prevalence of food allergy has been reported as 10%, with the highest percentage noted among younger children (Osborne et al., 2011). Furthermore, there is growing evidence of increasing prevalence in developing countries. (Loh & Tang, 2018) The most common causations of allergic reactions to food, particularly in children, are suggested to be cow's milk, egg, wheat, soy, peanut, tree nuts, fish, and shellfish (Allen & Koplin, 2012). Symptoms of these allergic reactions are, for example, abdominal pain, tightness of the throat, vomiting, diarrhoea, or in severe cases even death (Sampson, 2004; Foucard & Malmheden Yman, 1999).

An example of an adverse reaction to food caused by a host-specific metabolic disorder is a food intolerance. Food intolerance refers to a reaction to food, which is delayed and in the majority of cases this reaction is not accompanied by detectable IgE antibodies. Lactose intolerance is an example of a food intolerance, whereby the body is unable to digest the main carbohydrate in milk products (Buttriss, 2008). The enzyme lactase, which normally digests lactose, is absent in people with a lactose intolerance. Lactase deficiency is present in up to 15% of northern European descent. (Swargerty, Walling & Klein, 2002) Common symptoms of a lactose intolerance are abdominal bloating and pain, flatulence, nausea and borborygmi (Vesa, Marteau & Korpela, 2000). Another example of a food intolerance is a gluten intolerance. Gluten intolerance, also called coeliac disease, is an immunologically mediated disorder characterized by small intestinal mucosal damage caused by the ingestion of certain storage proteins of wheat, barley, and rye (Bardella et al., 2005). The prevalence of coeliac disease is approximately 1% of the population (Levy, Bernstein & Silber, 2014).

Since the primary therapy for food allergies and food intolerances is to avoid causal food, it is important for consumers to know what is in a food product to make an informed choice (Sicherer & Sampson, 2006; Pascual, Crespo, Perez & Esteban, 2000). The consumers' right to this information is regulated at European Union (EU) level in Regulation (EU) No 1169/2011[1] (hereafter: The Food Information to Consumer Regulation).

[1] Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers, amending Regulations (EC) No 1924/2006 and (EC) No 1925/2006 of the European Parliament and of the Council, and repealing Commission Directive 87/250/EEC, Council Directive 90/496/EEC, Commission Directive 1999/10/EC, Directive 2000/13/EC of the European Parliament and of the Council, Commission Directives 2002/67/EC and 2008/5/EC and Commission Regulation (EC) No 608/2004 Text with EEA relevance OJ L 304

The Food Information to Consumer Regulation (FIR) states that it is mandatory to indicate any ingredient which can cause one of the fourteen stated allergens and intolerances on food packages. These ingredients are crustaceans, eggs, fish, peanuts, soybeans, milk, nuts, celery, mustard, sesame, sulphur dioxide/sulphites, lupin, molluscs, and cereals containing gluten.

The fact that the FIR makes allergen labelling mandatory has improved the safety of food for the allergic consumer. However, an additional form of voluntary labelling, namely precautionary allergen labelling (PAL), has evolved on a wide range of packaged foods to minimize the risk to consumers. This is mainly done by food business operators to minimise the negative impact on their business (Allen et al., 2014). These warnings include statements, such as 'may contain'. However, PAL can lead to confusion by consumers. Some consumers, for instance, believe that variations in the PAL statements reflect the level of risk. They believe, for example, that 'may contain' indicates a higher risk than 'may contain traces'. Furthermore, consumers perceive that PAL refers to the unintended presence of an allergen only in 'trace' amounts. When a product with a PAL does not cause an allergic reaction, the consumer can see this product as 'safe'. This can result in unintended risky behaviour of consumers, who may continue to consume the product more often. (Barnett et al., 2011)

Taken together, PAL can lead to confusion. Moreover, it can lead to mistrust and ultimate anxiety. Consequently, consumers with a food allergy have difficulties with making an informed choice. (DunnGalvin et al., 2015) Therefore, helping consumers make an informed choice, many products nowadays have a claim on the food package suggesting a product is 'free from' a certain ingredient, for instance, 'lactose-free' or 'gluten-free'. There is still a growing number of food business operators making these claims on their food products (BRC and FDF, 2015). These claims can be made by words (textual claims), symbols, and symbols including text. In contrast to the ingredients present in the final product causing an allergy or intolerance which are mandatory to mention, the FIR does not include rules on stating whether a product is 'free-from' such ingredients.

Obviously, those claims, such as lactose-free and gluten-free, are very useful for people with an allergy or intolerance. However, over the last couple of years, there has been an increase in sales of lactose-free and gluten-free products, and factors other than an increase in lactose and gluten intolerance are probably responsible for that development (Christoph, Larson, Hootman, Miller, & Neumark-Sztainer, 2018; Gaesser & Angadi, 2012; Hartman, Hieke, Taper & Siegrist, 2018). One of the possible causing factors could be a widespread belief that a gluten-free diet is healthier and adequate to manage weight (Christoph et al., 2018; Gaesser & Angadi, 2012). Recent studies show that even people without a food allergy or intolerance perceive products with the claims 'gluten-free' and 'lactose-free' as healthier (Hartman et al., 2018; Priven, Baum, Vieira, Fung & Herbold, 2015; Prada et al., 2019). However, those benefits are falsely attributed to those products. Studies have shown that a gluten-free diet is associated with an increased calorie and fat intake and deficiencies in minerals and vitamins (Miranda et al., 2014; Wu et al., 2015). Besides, the advantages of reduced lactose or lactose-free dairy products

are not likely to have a different nutritional effect on the human body compared to normal dairy products (Dekker, Koenders & Bruins, 2019). Therefore, gluten-free and lactose-free products are unlikely to provide health benefits compared to conventional products, except when there is clear evidence of gluten intolerance, celiac or lactose intolerance. (Miranda, Lasa, Bustamante, Churruca, & Simon, 2014; Wu et al., 2015; Suchy et al., 2010)

Another possible factor that could have caused the increase in sales of lactose-free and gluten-free products is the marketing of the food industry. Making claims on a food product is allowed when the claim complies with Regulation (EC) No 1924/2006 [2] (hereafter: Nutrition and Health Claim Regulation). When buying food products, packaging is the first thing consumers notice. This definitely can have a great influence on consumer buying behaviour. Putting claims or symbols on a food package is a way to attract consumers to buy that specific product (Mengler-Ogle & Graham 2018). In general, consumers perceive a product with a claim as healthier than a product without a claim (Dean et al., 2007; Urala, Arvola & Lähteenmäki, 2003). Moreover, multiple studies suggest that visual representation, like symbols, have a greater influence than verbal messages (Carrillo, Fiszman, Lähteenmäki & Varela, 2014; Kapsak, Schmidt, Childs, Meunier & White, 2008). When using free-from claims on food packages this can cause the halo effect to consumers. The halo effect is a cognitive bias, where one trait of something influences how someone feels about other, unrelated traits. (Messer, Costanigro & Kaiser, 2017). Companies are aware of this effect and therefore can use lactose-free and gluten-free claims as a marketing tool.

Concerning that some people consume lactose-free and gluten-free products because of their intolerance, whereas other people just include those products in their lifestyle, and other people do not even care, there is a conflict between different health interests of consumers. Since the objective of the FIR is that food information shall ensure a high level of protection of consumers' health and interests, it is questionable whether all those interests are included.

1.2 Research question

Despite recent studies, experimental research examining the impact of lactose-free and gluten-free symbols, textual claims, and symbols including text on consumers' perception is still scarce. Therefore, this research aims to provide more data on the consumer perception and intent behaviour regarding those claims. In addition, it will be examined if there is a difference in perception between textual claims, symbols, and symbols including text. From a legal perspective, lactose-free and gluten-free claims are interesting to compare since gluten-free claims are regulated at EU level, whereas lactose-free claims are not.

[2] Regulation (EC) No 1924/2006 of the European Parliament and of the Council of 20 December 2006 on nutrition and health claims made on foods [2002] OJ L 404

Accordingly, this research aims at providing an answer to the following research question:

What is the consumer perception and intent behaviour regarding lactose-free and gluten-free claims and could this have legal implications?

To support the answer to this main research question, the question is divided into the following sub-questions:

- *How are making lactose-free and gluten-free claims on food products currently regulated at EU level?*
- *What is scientifically known about the consumer perception of lactose-free and gluten-free claims?*
- *What is the consumer perception of gluten-free and lactose-free claims?*
- *What is the consumer perception and intent behaviour regarding products with gluten-free and lactose-free claims?*
- *Could the consumer perception and intent behaviour regarding lactose-free and gluten-free claims have legal implications?*

The knowledge provided by this research can be used by policymakers when making amendments to the law or when setting up new legislation to ensure a high level of consumer protection regarding food information. Furthermore, the knowledge of this research can be used by people who are responsible for providing information to consumers about good nutrition.

1.3 Methodology

To investigate the research question, a literature review and experimental research are conducted which will be explained in more detail in the next two sections.

1.3.1 Literature review

To answer the sub-questions 'How are making lactose-free and gluten-free claims on food products currently regulated?' and 'What is scientifically known about the consumer perception of lactose-free and gluten-free claims?' a literature review was performed. The literature review aimed to provide a legal background and information on what is already known about consumer perception of those claims on food packages.

For the literature review, the following databases were used: Google Scholar, PubMed, WUR Library, Scopus, and EUR-Lex. To search for relevant articles on those databases the following search terms were used: 'Directive 2005/29/EC', 'Regulation 1169/2011', 'Regulation 1924/2006', 'Regulation 828/2014', 'Regulation 2016/127', 'free-from', 'gluten-free', 'lactose-free', 'consumer perception', 'gluten', 'lactose', 'definition claim', 'definition symbol', 'symbol used as claim', 'influence symbol on consumer', 'influence textual claim on consumer', 'influence symbol including text on consumer', 'misleading', 'confusing', 'ambiguous', 'clear', 'accurate', and 'understandable'.

For the literature review, only English and Dutch articles were reviewed. All articles on the consumer perception of lactose-free and gluten-free claims were included. Only legislation at EU level was included. Besides, articles that elaborate on the legal concepts and rules set out by Regulation 1169/2011 and Directive 2005/29 were included.

1.3.2 Experimental research

Next to the literature review, an experimental research was performed. The experimental research aimed to answer the sub-questions 'What is the consumer perception of gluten-free and lactose-free claims?' and 'What is the consumer perception and intent behaviour regarding products with a gluten-free and lactose-free claim?'. For the experimental research, a questionnaire was made via WUR Qualtrics, which was distributed online. Data was analysed by the Statistical Package for the Social Sciences (SPSS). People who were living outside the EU were excluded from the experiment since this research is on EU legislation. Furthermore, results from partially completed questionnaires and results from questionnaires finished within 180 seconds were excluded. More details on the experimental research can be found in Chapter 4.

1.4 Outline

The outline of this research will start with Chapter 2 on the current legislation of free-from claims. This chapter elaborates on how making claims on food products are currently regulated, particularly focused on lactose-free and gluten-free claims. Besides explaining which rules apply to those claims, some legal concepts are more clarified to better understand the applicable rules. Chapter 3 provides information on what is already known about consumer perception of textual claims, symbols, and symbols including text on food products. Chapter 4 on the experimental research includes the methodology used, the results from the experiment and a discussion on the experiment itself. Thereafter, Chapter 5 provides a bigger discussion on whether the consumer perception and intent behaviour regarding lactose-free and gluten-free claims could have legal implications. Lastly, Chapter 6 provides the conclusions of this research and specify what these conclusions could mean for society and policymakers by giving some recommendations.

2. Current legislation 'free-from' claims

In order to investigate which legislations are applicable for lactose-free and gluten-free textual claims, symbols, and symbols including text, a literature review is performed. In this chapter, the legislations applicable to those claims will be elaborated in more detail. The first section will identify which legislations are applicable. The second, third, and fourth sections of this chapter will explain the rules as set out in the applicable legislation in more detail. Furthermore, those applicable rules include some legal concepts which will be elaborated in the last section of this chapter. The analyses of the different regulations will provide a better inside into how free-from claims are currently regulated, especially for gluten-free and lactose-free claims.

2.1 Legislation applicable to lactose-free and gluten-free claims

To determine how lactose-free and gluten-free products are currently regulated at EU level, this section identifies which legislations are applicable. There is one regulation that provides general rules for making claims, which was seen as the most logical legislation applicable to lactose-free and gluten-free claims. This legislation is called the Nutrition and Health Claims Regulation. According to Recital 8 of the Nutrition and Health Claims Regulation, there is a wide range of nutrients present in food which can be the subject of a claim. To ensure a high level of consumer protection and making sure a consumer can make an informed choice, as well as creating equal conditions of competition for the food industry, it is important to set up general principles which apply to all claims made on food products. Moreover, Recital 9 of the Nutrition and Health Claims states that undesirable effects caused by claims should be avoided by setting up restrictions. Undesirable effects, in this case, are that consumers can perceive a product as having a nutritional, physiological or another health advantage over similar or other products. This can result in other choices made by the consumer which can influence the intake of nutrients or substances contradicting to scientific advice. As a result, the Nutrition and Health Claims Regulation states in Article 1 that the subject matter of this Regulation is to "harmonise the provisions laid down by law, regulation or administrative action in Member States which relate to nutrition and health claims in order to ensure the effective functioning of the internal market whilst providing a high level of consumer protection".

According to the Nutrition and Health Claims Regulation lactose-free and gluten-free claims can be seen as nutrition claims. To ensure a general understanding of what is seen as a claim, Article 2 of the Nutrition and Health Claims Regulation provides the following general legal definition: "a claim means any message or representation, which is not mandatory under Community level, including pictorial, graphic or symbolic representation, in any form, which states, suggests or implies that a food has particular characteristics". Besides, the Nutrition and Health Regulation distinguishes three types of claims, namely nutrition claims, health claims, and reduction of disease risk claims. The definition of a nutrition claim is as follows: "Nutrition claim means any claim which states, suggests or implies that a food has particular beneficial nutritional properties due to: (a) the energy (calorific value) it (i) provides, (ii) provides at a reduced or increased rate, or (iii) does not provide; and/or (b) the nutrients or other substances it (i) contains, (ii) contains in reduced or increased proportions, or (iii) does not contain;".

This means that a food product which suggests being 'free-from' a nutrient with text, pictorial, graphic or symbolic representation can be seen as a nutrition claim, where nutrient refers to a protein, carbohydrate, fat, fibre, sodium, vitamins or minerals, and substances or components of those. Gluten are proteins (Wieser, 2007) and lactose is a carbohydrate (Gekas & Lopez-Leiva, 1985). Therefore, lactose-free and gluten-free symbols, textual claims, and symbols including text are nutrition claims.

Even though, gluten-free and lactose-free claims can be seen as nutrition claims, they do not fall under the scope of the Nutrition and Health Claims Regulation. Article 8 of the Nutrition and Health Claims Regulation states that "nutrition claims shall only be permitted if they are listed in the Annex and are in conformity with the conditions set out in this Regulation". Regarding 'free-from' labelling, the Annex states only rules on energy-free, fat-free, saturated fat-free, sugar-free, sodium-/salt-free claims. Therefore, lactose-free and gluten-free claims do not fall under the scope of this Regulation and should be prohibited (Meisterernst & Haber, 2007).

Nevertheless, it is stated by recital 21 of the Nutrition and Health Claims Regulation that gluten-free and lactose-free claims should be dealt with under Council Directive 89/398/EEC. However, when analysing this in more detail, it seems to be confusing in which legislation lactose-free and gluten-free claims are regulated. When looking at the gluten-free claims we have to start with the fact that Council Directive 89/398/EEC is no longer in force. That Directive is repealed by other legislation. The current applicable legislation is Regulation (EU) No 609/2013 [3] (hereafter: Food for Specific Groups Regulation). In the Food for Special Groups Regulation it is stated that gluten-free statements should be dealt with Commission Regulation (EC) No 41/2009 [4] (hereafter: Gluten-Free Foodstuffs Regulation), taking into account rules set out by the FIR. The Gluten-Free Foodstuffs Regulation sets out harmonised rules on information provided to the consumer on the absence or reduced presence of gluten. It states limits for when it is allowed to make the claims 'gluten-free' and 'very low gluten'. However, the Gluten-Free Foodstuffs Regulation is no longer in force and is repealed by the Food for Specific Groups Regulation. This can be seen as confusing since the Nutrition and Health Claims Regulation states that rules on gluten-free claims should be regulated by the Food for Specific Groups Regulation, but in the end, the Food for Specific Groups Regulation sets out no rules on gluten-free claims.

[3] Regulation (EU) No 609/2013 of the European Parliament and of the Council of 12 June 2013 on food intended for infants and young children, food for special medical purposes, and total diet replacement for weight control and repealing Council Directive 92/52/EEC, Commission Directives 96/8/EC, 1999/21/EC, 2006/125/EC and 2006/141/EC, Directive 2009/39/EC of the European Parliament and of the Council and Commission Regulations (EC) No 41/2009 and (EC) No 953/2009 [2013] OJ L 181

[4] Commission Regulation (EC) No 41/2009 of 20 January 2009 concerning the composition and labelling of foodstuffs suitable for people intolerant to gluten [2009] OJ L 16

Although there are no specific rules set out by the Food for Specific Groups Regulation, there is another legislation setting out rules on gluten-free claims, namely Commission Implementing Regulation (EU) No 828/2014 [5] (hereafter: Gluten-Free Food Regulation). The Gluten-Free Food Regulation states in Recital 4 that even though the Food for Specific Groups Regulation repeals the Gluten-Free Foodstuffs Regulation, it is still important to ensure that the provision of information on the absence of gluten is based on scientific data and do not mislead or confuse consumers. Therefore, the Gluten-Free Food Regulation applies to the provision of information to consumers on the absence or reduced presence of gluten in food.

The fact that it seems to be confusing which legislation applies to gluten-free claims also seems to be the case for lactose-free claims. In the Food for Specific Groups Regulation it is stated by recital 42 that for lactose-free labelling there are no rules harmonized at Union level. Nevertheless, it is also stated that those indications are important for people who are intolerant to lactose. Therefore, it is stated that statements indicating the absence or reduced presence of lactose should be regulated by FIR. However, no specific rules on lactose-free labelling are set out by the FIR.

Even though the Food for Specific Groups Regulation states that there are no rules for lactose-free labelling harmonized at Union level, there is one category of food products for which there are specific rules on lactose-free statements, namely infant formula and follow-on formula. Those rules are set out by Commission Delegated Regulation (EU) 2016/127 [6] (hereafter: Infant Formula and Follow-On Formula Regulation). In this Regulation it is stated when it is allowed to use lactose-free statements on infant formula and follow-on formula. It should be noted that most of the industry also uses the limits as set out in this Regulation for other products than infant formula or follow up formula. (Allergenen Consultancy, n.d.). Furthermore, Germany is the only EU country which has national legislation on lactose-free products, but only sets out rules on dairy products. Since the main focus of this research is on legislation at EU level, only the Infant Formula and Follow-On Formula Regulation is analysed in more detail as applicable legislation on lactose-free claims.

Considering that both specific regulations on lactose-free and gluten-free claims stated that information provided to the consumer should comply with the FIR, this is the last Regulation applicable to such claims.

In the following sections, the three applicable regulations, the FIR, the Gluten-Free Food Regulation, and the Infant Formula and Follow-On Formula Regulation are elaborated in more detail.

[5] Commission Implementing Regulation (EU) No 828/2014 of 30 July 2014 on the requirements for the provision of information to consumers on the absence or reduced presence of gluten in food [2014] OJ L 228

[6] Commission Delegated Regulation (EU) 2016/127 of 25 September 2015 supplementing Regulation (EU) No 609/2013 of the European Parliament and of the Council as regards the specific compositional and information requirements for infant formula and follow-on formula and as regards requirements on information relating to infant and young child feeding [2016] OJ L 25

2.2 Food Information to Consumers Regulation (FIR)

To start with the overarching regulation, the FIR, which is applicable to both lactose-free and gluten-free claims. The FIR on the provisions of food information to consumers sets out its general provisions in Article 1. According to Article 1.1, this Regulation provides the basis for ensuring a high level of consumer protection concerning food information. This includes differences in the perceptions of people and differences in the information they need. In Article 1.2 it is described that this Regulation sets out the general principles, requirements, and responsibilities concerning food information with emphasis on food labelling. Furthermore, it ensures the right of consumers to have information and procedures for the provision of food information available. Article 1.3 informs that this Regulation shall apply to food business operators at all stages of the food supply chain and all foods for the final consumers. Next to food business operators this Regulation also applies to catering services.

Article 3 of the FIR sets out general objectives on food information. The first objective is that food information shall ensure a high level of protection of consumers' health and interests by making it possible for consumers to make an informed choice and use the food safely. The second objective is to achieve, in the Union, the free movement of legally produced and marketed food and stimulating the production of quality products. The third objective is when there are new requirements regarding the food information law, there will be a transition period, which allows products not complying yet with the law to be placed on the market until this period ends. The last objective is that an open and transparent public consultation will be conducted when preparing, evaluating, or revising the food information law.

Chapter 3 of the FIR sets out general food information requirements. As a basic requirement, for all food intended to the final consumer and mass caterers, Article 6 states that food shall be accompanied by food information in accordance with the FIR. Besides, as stated by Article 7 on fair information practices food information shall not be misleading. Moreover, food information should be accurate, clear and easy to understand for the consumer.

Chapters 4 and 5 the FIR distinguishes two types of information presented to the consumer, namely mandatory food information and voluntary food information. Mandatory food information is all information that has to be on a food package. Voluntary information is all information on a food product which is not mandatory. Article 9 of the FIR states a list of mandatory particulars. One of the mandatory particulars is indicating ingredients present in the finished product which can cause allergies or intolerances. The ingredients that have to be mentioned in case they are present in the final product are specified in the Annex. Lactose and cereals containing gluten are listed in the Annex. This means that if one of those is present in the final product, it is mandatory to mention those on the food package. However, indicating a product is free from lactose or gluten is not mandatory and therefore those claims can be seen as voluntary information. In Article 36 on applicable requirements for voluntary information it is stated that the information shall not be misleading, ambiguous or confusing for the consumer and should be based on relevant scientific data. In particular, for information on the absence or reduced presence of gluten, it is stated that the Commission shall adopt implementing acts on

the application of those requirements. This is probably done by adopting the Gluten-Free Food Regulation, which will be discussed in the next section. Article 37 of the FIR is about the presentation of voluntary food information and states that this information must not be displayed on the space intended for mandatory information.

To conclude, according to the FIR lactose-free and gluten-free claims can be seen as voluntary information. Since this Regulation aims a high level of consumer protection concerning food information, lactose-free and gluten-free claims shall not be misleading, ambiguous or confusing to the consumer. Furthermore, these claims shall be based on scientific literature and should be accurate, clear and easy to understand for the consumer.

2.3 Gluten-Free Food Regulation

Besides the overarching legislation applicable to both lactose-free and gluten-free claims, specific rules on the usage of gluten-free claims are set out in the Gluten-Free Food Regulation. Recital 1 and Recital 2 of this Regulation state that gluten can cause adverse health effects to people who have a gluten intolerance. These people should avoid gluten consumption. Therefore, information on the absence or reduced presence of gluten in food can help the people intolerant to gluten to choose their food. For that reason, Article 1 states that the Gluten-Free Food Regulation "applies to the provision of information to consumers on the absence or reduced presence of gluten in food". What is meant by gluten is elaborated in Article 2. The definition of gluten is "a protein fraction from wheat, rye, barley, oats or their crossbred varieties and derivatives thereof, to which some persons are intolerant, and which is insoluble in water and 0,5 M sodium chloride solution;".

Article 3 of the Gluten-Free Food Regulation laid down some general requirements for information to the consumers. It is stated that the information provided to the consumers can only be given by statements that are in accordance with the Annex. The statements that can be made are 'gluten-free' and 'very low gluten'. It is allowed to use the statement 'gluten-free' when the final product does not contain more than 20mg/kg of gluten. The statement 'very low gluten' can only be made when the final product consists of one or more ingredients made from, for example, wheat or oats, which have been specially processed to reduce gluten content and do not exceed the limit of 100mg/kg of gluten. Moreover, it is allowed to complement the statements 'gluten-free' and 'very low gluten' with the statements 'suitable for people intolerant to gluten' or 'suitable for coeliacs'. Furthermore, 'gluten-free' and 'very low gluten' statements may be accompanied by the statements 'specifically formulated for people intolerant to gluten' or 'specifically formulated for coeliacs' if the food product is produced, prepared or processed to reduce the gluten content or when gluten-containing ingredients are replaced by ingredients naturally free of gluten. It should be noted, that according to Recital 10, indicating the absence of gluten when the product is made of ingredients naturally free of gluten should comply with the FIR. In particular, rules stating that food information should not be misleading by suggesting that the food possessed special characteristics when in fact all similar foods possess such characteristics. To clarify what is seen as misleading, an example will be given on water. In principle, water does never contain gluten. Accordingly, every bottle of water should never

have a gluten-free claim on its package, since all other bottles of water have the same characteristic. If there is still a gluten-free claim on a package of water, this is regarded as misleading. (Carreño & Vergano, 2014)

However, even when the statement complies with all rules set out in the Gluten-Free Food Regulation, there is only one category of food products for which it is prohibited to make such statements. Article 4 states that it is prohibited to make such statements on infant formula and follow-on formula.

To conclude, it is allowed to make two different statements, namely 'gluten-free' and 'very low gluten' on food products if they do not exceed the limits as set out by the Gluten-Free Food Regulation, except for infant formula and follow on formula. Besides, when food products are made of ingredients naturally free of gluten, the information should not be misleading by suggesting it has special characteristics when all similar foods have such characteristics.

2.4 Infant Formula and Follow-On Formula Regulation

Besides the overarching legislation, the FIR, there is also more specific legislation for lactose-free claims. Rules on the usage of lactose-free claims are set out by the Infant Formula and Follow-On Formula Regulation. This Regulation is the only Regulation setting out rules on lactose-free claims at EU level. In Article 8 of the Infant Formula and Follow-On Formula Regulation it is stated that nutrition and health claims made on infant formula are not allowed. Whereas Article 9 states that the statements 'lactose-free' are allowed on infant formula and follow-on formula if it does not exceed the limit of 2,5 mg/100 kJ (10 mg/100 kcal) lactose. When the product states to be lactose-free and is made from protein sources other than soya protein isolates, it shall be accompanied by the statement 'not suitable for infants with galactosaemia'. The reason for allowing such claims is stated by Recital 19. This Recital states that statements on the presence or absence of lactose in infant formula and follow-on formula can be useful to parents and caregivers. Therefore, this Regulation laid down rules on such statements. More specific requirements on food information are set out by Article 6, which states that infant formula and follow-on formula in principle need to comply with the FIR.

To conclude, it is allowed to make the claims 'lactose-free' on infant formula, since it is stated in the recitals of the Infant Formula and Follow-On Formula Regulation that such a claim can be useful for parents or caregivers. It is allowed to use such a claim on infant formula if the product does not exceed the limit of 2,5 mg/100 kJ lactose and complies with the FIR.

2.5 Meaning of legal concepts

The previous sections elaborated on the different legislations applicable to lactose-free and gluten-free textual claims, symbols, and symbols including text. Regarding consumer perception and intent behaviour, it is interesting to see that the law takes this into account by stating that food information shall not be misleading, ambiguous, or confusing for the consumer. Furthermore, it should be accurate, clear, and easy to understand for the consumer. Since this research is interested in the consumer perception and intent behaviour regarding lactose-free and gluten-free claims and if this could have legal implications, it is important to understand those legal concepts. Therefore, this section elaborated on what is meant by those concepts in the natural and legal sense.

2.5.1 Misleading

One of the requirements for food information is that it should not be 'misleading'. Two legislations elaborate on this legal concept. The first one is Directive 2005/29/EC [7] (hereafter: Unfair Commercial Practices Directive'). The Unfair Commercial Practices Directive (UCPD) applies to all kinds of products, so not only food products. The second legislation elaborating on the concept misleading is the FIR. The FIR complements the UCPD by more specific rules for only food information. In the following paragraphs, it is explained what is considered as misleading according to the UCPD and the FIR.

The UCPD aims to achieve the proper functioning of the internal market and ensure a high level of consumer protection. Under the UCPD placing lactose-free and gluten-free claims on food packages can be seen as commercial practices. Commercial practices are defined in Article 2 as acts, omissions, courses of conduct or representations, and commercial communication by a trader which are directly connected with the promotion, sale or supply of a product to the consumer.

To ensure a high level of consumer protection, unfair commercial practices are prohibited. Article 5 states that misleading practices are seen as unfair commercial practices. Misleading practices are divided into misleading actions and misleading omissions, which are covered by Article 6 and Article 7 respectively. Article 6 on misleading actions states that "A commercial practice shall be regarded as misleading if it contains false information and is therefore untruthful or in any way, including overall presentation, deceives or is likely to deceive the average consumer, even if the information is factually correct, in relation to one or more of the following elements, and in either case causes or is likely to cause him to take a transactional decision that he would not have taken otherwise". One of the elements covered by Article 6 is the main product characteristics, which include, for instance, benefits, risks, execution, and

[7] Directive 2005/29/EC of the European Parliament and of the Council of 11 May 2005 concerning unfair business-to-consumer commercial practices in the internal market and amending Council Directive 84/450/EEC, Directives 97/7/EC, 98/27/EC and 2002/65/EC of the European Parliament and of the Council and Regulation (EC) No 2006/2004 of the European Parliament and of the Council ('Unfair Commercial Practices Directive') OJ L 149, 11.6.2005

composition. Therefore, when using lactose-free and gluten-free textual claims, symbols, and symbols including text, it is important to take into account that such claims do not lead to a transactional decision that a consumer would not have taken otherwise because such claims suggest that the product has special characteristics. Article 7 on misleading omissions sets out that a commercial practice shall be regarded as misleading if it omits material information that the average consumer needs to make an informed choice and therefore causes a transactional decision which he would not have taken otherwise.

Besides those general principles on unfair commercial practices, specific rules on fair information practices are set out by Article 7 of the FIR. This Article states that food information shall not be misleading, specifically as to characteristics of the food, such as its nature, identity, properties, composition, and quantity. Furthermore, it shall not be misleading by attributing to food effects or characteristics which it does not possess or by suggesting the presence of a food or ingredient, while in reality a component naturally present or a standard ingredient has been substituted with another component or ingredient. It shall also not be misleading by suggesting that the food has special characteristics when in fact all similar food products have such characteristics, particularly indicating the presence or absence of an ingredient or nutrient. The last provision includes for gluten-free and lactose-free textual claims or symbols that it is not allowed to label, for example, mineral water as "naturally gluten-free" (Carreño and Vergano, 2014).

As previously specified the UCPD considered a commercial practice as misleading if an average consumer would be misled by it. In other words, the average consumer is used as a reference point to determine any misleading commercial practice (Schebesta & Purnhagen, 2019). The concept 'average consumer' is interpreted in the case law of the Court of Justice of the European Union (CJEU) as 'a consumer, who is reasonably well-informed and reasonably observant and circumspect, taking into account social, cultural, and linguistic factors (Gut Springenheide and Tusky v Oberkreisdirektor Steinfurt, 1998). As explicitly mentioned by Recital 18 of the UCPD, the average consumer test is not a statistical test. This means "that national authorities and courts should be able to determine whether a practice is liable to mislead the average consumer exercising their own judgment by taking into account the general presumed consumers' expectations, without having to commission an expert's report or a consumer research poll" (European Commission, 2016). Besides, it is stated by Recital 18 that when a commercial practice is aimed at a specific group of consumers, for instance children, the impact of the commercial practice should be assessed from the perceptive of the average member of that group.

In contrast to the UCPD, which uses the concept of the 'average consumer' on a systematical level, the FIR only uses this concept in an isolated provision. (Schebesta & Purnhagen, 2019) The average consumer is only mentioned in the FIR in Article 35 on the additional forms of expression and presentation of mandatory information. However, since the FIR complements the UCPD, it is assumed that the FIR also uses the average consumer benchmark to determine whether food information is misleading.

To conclude, lactose-free and gluten-free textual claims, symbols, and symbols including text shall not be misleading, specifically as to characteristics of the food. This is covered by the FIR and the UCPD. However, in contrast to the FIR, the UCPD include that something can only be seen as misleading if it also causes a transactional decision which a consumer would not have taken otherwise. The average consumer is used as a benchmark to determine whether something can be seen as misleading. National authorities and courts have to mandate to apply and fill the average consumer with meaning.

2.5.2 Other concepts

Besides misleading, the FIR states that food information shall also not be ambiguous and confusing. Moreover, it should be accurate, clear, and easy to understand for the consumer. In contrast to the concept misleading, those concepts are not further elaborated by this Regulation. After a literature review, no clear explanation on these concepts and no CJEU case law was found. Therefore, what is legally seen as ambiguous, confusing, accurate, clear, understandable, seems to be open-ended in EU law. In order to provide a working definition for those concepts, this research relied on textual interpretation, which is discussed below.

A legal definition of 'ambiguous' is found in the Oxford Dictionary of Law. In this dictionary, ambiguous is defined as "uncertainty in meaning". An example that is given on uncertainty in meaning is when a testament is stating "I give my gold watch to X", while in fact, the testator has two gold watches. (Law, 2018) So, this statement has more than one meaning, which leads to uncertainty. For gluten-free and lactose-free textual claims, symbols, and symbols including text, this means that they shall not lead to uncertainty in meaning by having more than one possible meaning.

A small explanation of the concept 'confusing' was found in Regulation (EU) 2017/1001 [8], which states in Article 8 that a trademark shall not be registered if "because of its identity with, or similar to, the earlier trademark and the identity or similarity of the goods or services covered by trademarks there exist a likelihood of confusion on the part of the public in territory in which the earlier trademark is protected; the likelihood of confusion includes the likelihood of association with the earlier trademark". However, gluten-free and lactose-free claims are not registered trademarks. Therefore, a definition of 'confusing' was found in the Cambridge dictionary. According to this dictionary, something is confusing when someone is "confused because something is difficult to understand" (Cambridge advanced learner's dictionary, 2008). This means, regarding lactose-free and gluten-free textual claims or symbols, that they should not be difficult to understand.

[8] Regulation (EU) 2017/1001 of the European Parliament and of the Council of 14 June 2017 on the European Union trademark [2017] *OJ L 154*

Definitions of ‘accurate’, ‘clear’, and ‘understandable’ were also found in the Cambridge dictionary. It states that ‘accurate’ means “correct, exact, and without any mistakes” (Cambridge advanced learner's dictionary, 2008). This means for lactose-free and gluten-free claims that they have to be made correctly, should be exact, and no mistakes can be made by using those claims.

‘Clear’ is defined as “easy to understand and having no doubt” (Cambridge advanced learner's dictionary, 2008). So, when making gluten-free and lactose-free claims consumers should understand them and they must be certain about the meaning of the claim.

The definition of ‘understand’ is that a person “knows the meaning of something” (Cambridge advanced learner's dictionary, 2008). In the case of lactose-free and gluten-free claims consumers should know what those claims mean.

Summarizing, what is legally seen as ambiguous, confusing, accurate, clear, and understandable seems to be open-ended in EU law. In CJEU practice these ‘open norms’ can, for instance, give the CJEU some leeway to consider for specific situations whether they are misleading. However, in order to provide a working definition for those concepts, this research relied on textual interpretation.

3. General consumer perception of lactose-free and gluten-free claims

As set out in the legal framework gluten-free and lactose-free textual claims, symbols, and symbols including text shall not be misleading, ambiguous, and confusing. Furthermore, those claims shall be clear, accurate, and easy to understand for the consumer. What the actual consumer perception is of such claims was investigated by this research by performing a literature review. The findings are described in this chapter.

3.1 Consumer perception textual claims

Based on the method used for the literature review, one study was found investigating the effect of textual claims on the consumer perception. The effect of gluten-free textual claims on consumer perception was investigated by a recent study of Priven et al. (2015). This study was based on findings from a study of Radam, Yacob, Bee & Selamat (2010) on the consumer perception of no monosodium glutamate (MSG) labelled food products. They suggested that no MSG labels may "generate and reinforce beliefs that MSG is harmful and/or an unsafe ingredient" (Radam et al., 2010, p66). This idea suggests that there could be some intrinsic quality to free-from labelling that influences consumers' health perception. In the study of Priven et al. (2015) that idea is examined. The aim was to investigate if free-from labelling can result in the perception that such labelled products are healthier or if risk information has to exist in order to lead to such perception. To examine the consumers' perception of products labelled with a MUI-free or gluten-free textual claims, a web-based survey was created. Two pictures of the same product were displayed in the survey, except that one of the two packages claims to be 'MUI-free' or 'gluten-free' as can be seen in Figure 1. The reason why they chose the 'gluten-free' claim is because the potential risk of products containing gluten is much discussed in the media. This is compared to the 'MUI-free' claim, which is specially formulated for this study, to make sure people are not influenced by risk information. Data of this study demonstrates that textual claims stating that a product is free-from a certain ingredient can result in perceiving a product as healthier in the absence of risk information. In the end, both MUI-free and gluten-free labelled food products were perceived as healthier. Additionally, education level and ethnicity seem to play an important role in generating perceptions about health.

Figure 1: Textual claim used in the study of Priven et al. (2015)

The study of Priven et al. (2015) was the only study found investigating the effect of gluten-free textual claims. This means that for the consumer perception of lactose-free textual claims no data was found.

3.2 Consumer perception symbols including text

The previous section discussed a study that examined the effect of gluten-free textual claims on consumer perception. In this section, two studies of Hartman et al. (2018) and Prada, Garrido & Rodrigues (2019) are discussed which examined the effect of lactose-free and gluten-free symbols including text on consumer perception.

The first study of Hartman et al. (2018) investigated the effect of GMO-free, palm oil-free, gluten-free, and lactose-free symbols including text on consumer perception of healthiness and the intention to pay. Furthermore, psychological factors, consumer attitudes, and emotional affect that might influence the healthiness perception and intention to pay were measured. The different symbols including text, as can be seen in Figure 2, were placed on several food products that are common in all European countries. The gluten-free symbol including text was placed on bread, pasta, and cookies. The lactose-free symbol including text was placed on cheese, milk, and yogurt. Data on consumer perception was obtained by an internet panel. The results from this study imply that consumers perceive free-from labelled products as healthier compared to products without such label. Several psychological and attitudinal factors influenced this perception, like information-seeking on food packages and preference for naturalness. Moreover, results imply that free-from labels might confuse consumers, by making them think that labelled is better than unlabelled. The only factor which attenuated the healthiness perception, preference for naturalness, and information seeking on the intention to pay for free-from labelled products was nutrition knowledge. To conclude, the study of Hartman et al. (2018) showed that consumers perceived a product with a lactose-free or gluten-free symbol including text as healthier.

Figure 2: Symbols including text used in the study of Hartman et al. (2018)

The second study of Prada et al. (2019) aims to replicate the findings of the impact of the gluten-free symbol including text on the perceived healthfulness. Furthermore, it examines the impact of the gluten-free symbol including text on other evaluative dimensions. These other evaluative dimensions are perceived caloric content, expected taste and level of processing (how much a product is transformed until its current stage). They used an online survey to collect data. The survey asked participants to evaluate four different food products, namely flour, bread loaf, rice, and rice crackers either with a green circle with the crossed grain symbol stating 'gluten-free' or only a green circle as can be seen in Figure 3. Participants had to indicate their evaluation on a 9-point rating scale. They had to indicate the healthfulness, taste, caloric content and level of processing of the different products. Furthermore, they had to indicate if a gluten-free diet is less caloric, healthier, adequate to weight loss, less processed, and natural compared to a conventional diet or the opposite thereof. After analysing the data, they concluded that participants reported to have a low level of knowledge about gluten-free products and have difficulties with indicating the gluten content of some food items. Nevertheless, participants reported having a positive belief about the gluten-free diet, for instance, that such a diet is healthier. The most important finding of this study was that consumers did not only perceive a product with a gluten-free symbol including text as healthier, but also as less caloric and less processed.

Figure 3: Symbol including text used in the study of Prada et al. (2019)

It is remarkable that both studies only compared products with a symbol including text with a normal product. As a result, they do not know if the effect on consumer perception was because

of the symbol or because of the text. Therefore, it is important for the experimental research to provide data on the consumer perception of symbols as well.

3.3 Consumer perception symbols

As elaborated in the previous sections there are in total 3 studies which investigated the effect of lactose-free and gluten-free textual claims and symbols including text. However, it should be noticed that based on the method used for the literature review of this research no study on the consumer perception of lactose-free and gluten-free symbols was found.

To conclude, this chapter showed that all three studies on the consumer perception of lactose-free and gluten-free claims concluded that consumers perceived products with such claims as healthier. Moreover, one of the studies concluded that a product with a gluten-free symbol including text does not only have an impact on the perceived healthiness but also extends to the caloric content and the level of processing. However, these characteristics are falsely attributed to such products, since gluten-free and lactose-free products are unlikely to provide health benefits compared to conventional products, except when there is clear evidence of gluten intolerance, coeliac disease, or lactose intolerance (Miranda et al., 2014; Wu et al., 2015; Suchy et al., 2010).

To provide more data on the actual consumer perception and intent behaviour regarding lactose-free and gluten-free claims, especially for lactose-free and gluten-free symbols, and lactose-free textual claims, this research set up an own experiment which is discussed in the next chapter.

4. Experiment: a study on consumer perception and intent behaviour regarding lactose-free and gluten-free claims

To provide more data on the consumer perception and intent behaviour regarding lactose-free and gluten-free claims an own experiment was performed using an online questionnaire. In this chapter, the experimental research is discussed. First, the methodology of the experiment will be explained. Second, the results of each question of the questionnaire will be shown. Third, there will be a small discussion on the results. It will be discussed what the results of the experiment mean. Furthermore, the results of lactose-free claims will be compared to gluten-free claims and some recommendations for further research will be given.

4.1 Methodology

In this section the methodology of the experiment will be explained. This includes the aim of the experiment, how data was collected, which questions were asked in the questionnaire, and how data was analysed.

4.1.1 Aim of the experiment

The experiment using an online questionnaire aimed to investigate what the consumer perception and intent behaviour is regarding lactose-free and gluten-free textual claims, symbols, and symbols including text to determine whether or not those claims can be misleading, ambiguous, confusing, clear, and understandable. The legal concept 'accurate' was not investigated. Accurate was defined as correct, exact, and without any mistakes. Regarding consumer perception, this seems to be difficult to measure since it is the responsibility of the food business operator to make the claim correctly and without mistakes.

4.1.2 Participants

Data collection took place between the 5th of December 2019 and the 7th of January 2020 in The Netherlands. The questionnaire was distributed online via email, intranet, WhatsApp, Facebook, and LinkedIn. All participants were screened as to whether they are currently living in the EU. The experiment included 379 individuals who voluntarily collaborated to the online study. 76 of the participants were excluded because they were either living outside the EU, or they did not fill in the questionnaire completely. Participants who had a response time below 180 seconds were also excluded. The final number of participants was 303.

4.1.3 Lactose-free and gluten-free labels

Six different food labels were investigated in the present study indicating that the labelled products were free of gluten or lactose. The labels were shown on two different food products that are common in all EU countries, namely yogurt and pasta. The lactose-free textual claim,

symbol, and symbol including text were presented on yogurt. The gluten-free textual claim, symbol, and symbol including text were presented on pasta. The products were designed based on images of real products available on the market. Pictures of the various claims and products presented to the participants can be seen in Table 1.

Table 1: Claims and products presented to participants

	Lactose-free		Gluten-free	
Textual	LACTOSE FREE		GLUTEN FREE	
Symbol				
Symbol incl. text				

4.1.4 Survey questions

In Chapter 2 the legal determinants of information to the consumer and the prohibition of misleading the consumer are identified. In this section the legal criteria are translated in variables to be tested in the survey.

The questionnaire was made in English and Dutch via WUR Qualtrics. There were three different questionnaires in total, one on symbols (condition 1), one on textual claims (condition 2) and one on symbols including text (condition 3). Participants were assigned randomly to one of the questionnaires. The option "evenly present elements" in Qualtrics was enabled to make sure the number of responses for each questionnaire was the same.

The questionnaire started with a *selection*. Participants had to agree to volunteer to collaborate in the study. If they did not agree they directly went to the end of the survey. Besides, participants had to indicate if they currently live in the EU. Since this research is focussed on EU legislation, only people from the EU were included. If the answer to that question was 'no', they also went directly to the end of the survey.

The *meaning* of lactose-free and gluten-free textual claims, symbols and symbols including text were measured by an open question. The question was as follows: "What do you think this textual claim/symbol/symbol including text means?". This question should provide an answer to the sub-questions whether or not lactose-free and gluten-free claims are clear and understandable for the consumer. Furthermore, this was asked to determine whether those claims are not misleading and confusing.

Perceptions of product characteristics were measured to determine whether or not lactose-free and gluten-free textual claims, symbols, and symbols including text can be misleading. The perceptions of product characteristics were measured the in the following way: the same product without (Product A) and with (Product B) the claim was presented to participants who had to indicate which product they considered as better for their health and which product they think contains more fat, vitamins, and calories. They had to indicate this perception on a 5-point response scale. The responses were verbally labelled as follows: A is much healthier/contains much more fat/vitamins/calories (1), A is somewhat healthier/contains somewhat more fat/vitamins/calories (2), A and B are equally healthy/have the same fat/vitamins/caloric content (3), B is somewhat healthier/contains somewhat more fat/vitamins/calories (4), and B is much healthier/contains much more fat/vitamins/calories (5). Besides, there was also a sixth option included, namely 'I don't know'.

Likeliness to buy was measured to determine whether lactose-free and gluten-free textual claims, symbols, and symbols including text can be misleading. Each time a picture with or without a claim was shown to the participants the following question was asked: "Imagine you are at the supermarket. How likely would you purchase this product?" They had to indicate the likeliness on an 11-point scale, where 0 was extremely unlikely and 10 was extremely likely.

Perception of the lactose and gluten content was measured to determine if lactose-free and gluten-free textual claims, symbols, and symbols including text can be misleading. Pictures of the textual claims, the symbols, or the symbols including text were shown to the participants. For both lactose-free and gluten-free claims they had to indicate what they think is the amount of lactose (mg/100 kcal) and gluten (mg/kg) in the product. Participants had to fill in a number in an open space.

Affect was measured by asking participants to indicate their feelings when they think about lactose or gluten. Therefore, participants had to answer the following question on a response scale from extremely negative (0) to extremely positive (10): "When you think of your first association with '[lactose or gluten]' does it evoke a negative or positive feeling?" The affect was measured because, based on previous research, this factor exerts an influence on the evaluation of products labelled as "free-from" (Asioli et al., 2017).

Consumption behaviour was measured to determine whether participants will consume certain products under normal circumstances. Participants answered the following question: "How often do you consume the following products '[pasta, yogurt, gluten-free products excl. products naturally free of gluten, and lactose-free products excl. products naturally free of lactose]'?" The response scale ranged from weekly (= 5) to never (=1). This question was asked since this factor was considered as a factor that could have influenced the results.

Participants' *attitudes towards eating healthily* were measured by the following question: "I attach great value to eating healthily". Participants had to indicate their level of agreement (strongly disagree = 1 to strongly agree = 7). This question was asked since this factor was considered as a factor that could have influenced the results.

Perception of the healthiness of a lactose-free and gluten-free diet was assessed by asking the participants the following question: "How healthy do you consider a lactose-free diet for yourself?" The response scale ranged from extremely unhealthy (0) to extremely healthy (10). The same question was asked for the perceived healthiness of a gluten-free diet. This question was asked because the perception of the healthiness of a lactose-free and gluten-free diet was considered as an influencing factor on the results.

Information seeking on food packages was measured for four items. In particular, they had to answer the following question: "When buying food products, how often do you look at the following information on food packaging?" - 1) nutrition information (e.g. the amount of sugar, calories, fat); 2) ingredient list; 3) claims referring to nutritional benefits (e.g. low sugar, reduced salt); 4) allergy information. The responses were verbally labelled as follows: never (1), rarely (2), occasionally (3), sometimes (4), always (5). This question was asked because information seeking was considered as an influencing factor on the results.

It was measured if participants having *food allergies or intolerances*. In case the answer was "yes" they had to specify which allergies or intolerances they have. Furthermore, they had to indicate if they are buying food products for a family member or a good friend who has a food allergy or intolerance. In the case the answer was "yes", they had to specify which allergies or intolerances their family member or good friend has. Those questions were asked because there was a possibility that participants with an allergy or intolerance or participants with a family member or good friend for who they need to buy food products filled in the questionnaire differently.

After those questions, participants had to provide *sociodemographic information*, namely age, gender, the country in which they currently live, country of origin and the highest level of school completed. Those questions were asked since those factors were considered as factors which could have influenced the results.

At the end of the survey, there was an open space in case participants had further comments.

4.1.5 Data analysis

After data collection, the results from the survey were imported into SPSS and analysed via SPSS. Three different analyses were performed, which will be descripted below.

First, the data was analysed per condition. Data on the meaning of lactose-free and gluten-free claims was analysed by Descriptive Statistics. The perceived product characteristics were also analysed by Descriptive Statistics. The likeliness to buy was analysed by a Paired Sample T-Test (two-tailed) and the perceived lactose and gluten content were analysed by a One Sample T-Test (two-tailed).

Second, the data was analysed between conditions to see if the condition influenced the results. For the meaning of lactose-free and gluten-free claims and the perceived product characteristics, this analysis was done by a Chi-square test. To see if the condition had a significant influence on the likeliness to buy and the perceived lactose and gluten content a One-Way ANOVA was executed.

Third, it was analysed if the conditions differ in some factors which could have influenced the results, such as gender, age, and having a food allergy or intolerance. To see if those factors are significantly different among the three conditions each possible influencing factor was analysed by a Chi-square test.

The SPSS analyses were done with a reliability of 95%. Hypotheses were rejected when the level of significance was below or equal to 0.05. This is reflected in a p-value smaller or equal to 0.05

4.2 Results

In this section the results of the questionnaire will be shown. The results of each question will be discussed separately.

4.2.1 Selection

First of all, people were selected based on whether they agree to participate in the study, if they are living in the EU and if the questionnaire was finished within 180 seconds. Even though the option "evenly present elements" in Qualtrics was enabled to make sure the number of responses for each questionnaire was the same, the final number of participants for each condition was not equal. The reason for this is that after data collection some participants were excluded, because they, for instance, did not fully complete the questionnaire. Consequently, condition 1 for symbols comprised 109 people (36%), condition 2 for textual claims comprised 100 people (33%), and condition 3 for symbols including text comprised 94 people (31%).

4.2.2 Meaning of lactose-free and gluten-free claims

After the selection, participants had to answer the first question "What do you think this symbol/textual claim/symbol including text means?". Regarding the results people provided many different definitions of lactose-free and gluten-free claims. The frequency of specific definitions given to lactose-free and gluten-free claims per condition can be found in Appendix 2.

For the statistical analyses each definition was classified as good or wrong. An overview of the frequencies of good and wrong definitions given to lactose-free claims can be seen in Table 2. Percentages in Table 2 represent the percentage of people in each condition who provided a good or wrong definition. Good definitions for lactose-free claims include, 'lactose-free', 'free-from milk sugars', 'can be consumed safely by consumers with a lactose intolerance'. 'contains only a little amount of lactose (below a certain specified limit)', 'no lactose added', and 'no lactose used for processing'. Other definitions were classified as 'wrong'. Since lactose is a carbohydrate in milk, it is not surprising that some wrong definitions at least relate to milk, for instance 'milk-free', 'dairy-free', or 'milk protein-free'. Other definitions do not even relate to milk. Some remarkable definitions were 'do not drink', 'do not shake', 'do not store opened packaging', and 'fragile'.

Table 2: Frequencies and percentages of good and wrong definitions given to a lactose-free claim. The Chi-square result is included for the comparison between the different conditions.

Definition		*f*	%	χ^2
Symbol	Good	31	28	p = <.001
	Wrong	78	72	
Text	Good	62	62	
	Wrong	38	38	
Symbol + text	Good	76	81	
	Wrong	18	19	

The results show that the majority of participants who had to define a lactose-free symbol provided the wrong definition. In contrast to participants who had to define the symbol, participants who had to define a lactose-free textual claim or symbol including text provided in majority of the cases a good definition. The percentage of good definitions given to a lactose-free claim was the highest for a lactose-free symbol including text. The Chi-square test (χ^2) shows significant difference among the three conditions, since the p-value is <.001.

An overview of the frequencies of good and wrong definitions given to gluten-free claims can be seen in Table 3. Percentages in Table 3 represents the percentage of people in each condition who provided a good or wrong definition. For gluten-free claims 'good' definitions include "gluten-free", "does not contain gluten or traces thereof", "no gluten used for processing", "contains only a little amount of gluten (below a certain specified limit)", "can be consumed safely by consumers with a gluten intolerance", "no gluten added", "no gluten-containing ingredients or products", and "without a certain protein that occurs in certain grains". Other definitions were classified as 'wrong'. The majority of wrong definitions is related to grain and wheat. However, there are some remarkable definitions as well, such as "do not pick flowers", "herbs", "not vegan", "not biologic", and "forbidden crops".

Table 3: Frequencies and percentages of good and wrong definitions given to a gluten-free claim. The Chi-square result is included for the comparison between the different conditions.

Definition		*f*	%	χ^2
Symbol	Good	60	55	p = <.001
	Wrong	49	45	
Text	Good	84	84	
	Wrong	16	16	
Symbol + text	Good	88	94	
	Wrong	6	6	

The results show that in all three conditions the majority of participants provided a good definition for gluten-free claims. However, the Chi-square test resulted in a significant difference among the three conditions (p = <.001). As can be seen in Table 3 the percentages

of good definitions for a textual gluten-free claim and symbol including text were much higher compared to the percentage of good definitions for a gluten-free symbol. When comparing the textual gluten-free claim and a symbol including text indicating a gluten-free product, the last one resulted in the highest percentage of good definitions.

Summarizing, for the definitions of a lactose-free claim it is remarkable that only for the lactose-free symbol the majority of people provided a wrong definition. In the case of a gluten-free claim in all three conditions, the participants provided a good definition. The results from the Chi-square test, for both claims, were statistically significant. Besides, a symbol including text resulted in the highest percentage of good definitions given to both claims among the three conditions.

4.2.3 Product characteristics

After the question on the meaning of a lactose-free and gluten-free symbol, the different claims were presented on two food products, namely yogurt and pasta. Participants had to evaluate four different product characteristics. A product without a claim was compared to a product with a claim. The evaluated characteristics were healthiness, fat content, vitamin content, and caloric content. In the next four sections, the perceptions of each characteristic are discussed for both lactose-free and gluten-free claims.

Healthiness

The first evaluated product characteristic was healthiness. Table 4 shows the results from the comparison between products without a lactose-free or gluten-free claim (A) and with a lactose-free or gluten-free claim (B) regarding the perceived healthiness of the products. Healthiness was defined as "the physical and mental condition". According to the results for both products among all three conditions the highest percentage of answers chosen was "A and B are equally healthy".

When looking at the other answers, the percentages among the other options are relatively the same, except for the answer "B is much healthier", which has the lowest percentage of answers chosen for both products among all three conditions. When comparing the actual percentage of participants who perceive A as healthier compared to the percentage of people who perceive B as healthier, there is a higher percentage of participants who perceive yogurt without a lactose-free claim and pasta without a gluten-free claim as healthier.

Another remarkable point is that the percentages of participants who chose the answer "I do not know" for the perceived healthiness of yogurt is higher compared to the percentage of participants who chose the option "I do not know" for the perceived healthiness of pasta.

Concerning the results from the Chi-square test, for the perceived healthiness of yogurt, the Chi-square test resulted in a p-value of .76, *ns*. Regarding the perceived healthiness of pasta, the Chi-square test resulted in a p-value .82, *ns*.

Table 4: Perceived healthiness of yogurt without a lactose-free claim (A) compared to yogurt with a lactose-free claim (B) and perceived healthiness of pasta without a gluten-free claim (A) compared to pasta with a gluten-free claim (B). The chi-square result is included for the comparison between the different conditions.

Perceived healthiness	Yogurt				Pasta			
	Symbol (%)	Text (%)	Symbol + text (%)	χ^2	Symbol (%)	Text (%)	Symbol + text (%)	χ^2
A is much healthier	8	4	7	p = .76, *ns*	7	6	5	p = .82, *ns*
A is somewhat healthier	12	11	9		13	14	12	
A and B are equally healthy	57	64	62		59	65	65	
B is somewhat healthier	9	5	9		7	9	9	
B is much healthier	0	1	2		6	1	3	
I do not know	14	15	12		7	5	6	

Fat content

After evaluating the healthiness of yogurt and pasta, participants had to indicate which product, with or without a lactose-free or gluten-free claim, they perceived as containing more fat. Table 5 shows the results from the perceived fat content of yogurt without a lactose-free claim (A) compared to yogurt with a lactose-free claim (B). Besides, it shows the perceived fat content of pasta without a gluten-free claim (A) and with a gluten-free claim (B).

According to the results, the majority of people perceive yogurt with and without a lactose-free claim and pasta with and without a gluten-free claim as having the same fat content. When looking at the other answers for both products among the three conditions results show that the percentage of people who perceive only A as healthier is higher compared to people who perceive only B as healthier. Furthermore, the percentages of participants who chose the answer "I do not know" for the perceived fat content of yogurt is higher compared to the percentage of participants who chose the option "I do not know" for the perceived fat content of pasta.

The Chi-square test resulted in a p-value of .097, *ns* for the comparison between the three conditions regarding the perceived fat content of yogurt. The comparison between the three conditions regarding the perceived fat content of pasta resulted in a p-value of .52, *ns*.

Table 5: Perceived fat content of yogurt without a lactose-free claim (A) compared to yogurt with a lactose-free claim (B) and perceived fat content of pasta without a gluten-free claim (A) compared to pasta with a gluten-free claim (B). The chi-square result is included for the comparison between the different conditions.

Perceived fat content	Yogurt				Pasta			
	Symbol (%)	Text (%)	Symbol + text (%)	χ^2	Symbol (%)	Text (%)	Symbol + text (%)	χ^2
A contains much more fat	13	9	3	p = .097, *ns*	1,8	2	1,1	p = .52, *ns*
A contains somewhat more fat	21	17	19		8,3	2	8,5	
A and B have the same fat content	36	51	59		73,4	79	77,7	
B contains somewhat more fat	11	10	6		2,8	5	3,2	
B contains much more fat	2	0	1		0	0	1,1	
I do not know	17	13	12		13,8	12	8,5	

Vitamin content

The third evaluated product characteristic was vitamin content. Table 6 shows the results from the perceived vitamin content of yogurt with a lactose-free claim (A) compared to a product with a lactose-free claim (B). Furthermore, Table 6 shows the percentages of answers given regarding the perception of the vitamin content of pasta without a gluten-free claim (A) compared to pasta with a gluten-free claim (B). For both yogurt and pasta among the three conditions, the majority of people answered "A and B have the same vitamin content". However, for the perceived vitamin content of yogurt, there are large differences in percentages between the three conditions. Not surprisingly, the Chi-square test is significant (p = .034).

When looking at the other results, the percentages among the other options are relatively the same, except for the answer "B contains much more vitamins", which has the lowest percentage of answers chosen for both products among all three conditions. When comparing the actual percentage of participants who perceive A as having a higher vitamin content compared to the percentage of people who perceive B as having a higher vitamin content, there is a higher percentage of participants who perceive yogurt without a lactose-free claim and pasta without a gluten-free claim as having a higher vitamin content. Besides, also in this case, the percentage of participants who chose the answer "I do not know" for the perceived vitamin content of yogurt is higher compared to the percentage of participants who chose the option "I do not know" for the perceived vitamin content of pasta. In contrast to the significant difference in the

perceived vitamin content of yogurt between the three conditions, the perceived vitamin content of pasta among the three conditions is not significantly different, since the Chi-square test provided a p-value .10, *ns.*

Table 6: Perceived vitamin content of yogurt without a lactose-free claim (A) compared to yogurt with a lactose-free claim (B) and perceived vitamin content of pasta without a gluten-free claim (A) compared to pasta with a gluten-free claim (B). The chi-square result is included for the comparison between the different conditions.

Perceived vitamin content	Yogurt				Pasta			
	Symbol (%)	Text (%)	Symbol + text (%)	χ^2	Symbol (%)	Text (%)	Symbol + text (%)	χ^2
A contains much more vitamins	6	5	3	p = .034	10	6	2	p = .10, *ns*
A contains somewhat more vitamins	16	7	10		12	14	12	
A and B have the same vitamin content	55	78	68		62	72	72	
B contains somewhat more vitamins	3	1	6		4	1	5	
B contains much more vitamins	1	0	0		0	0	2	
I do not know	20	9	13		12	7	6	

Caloric content

The last product characteristic that was evaluated is caloric content. Table 7 shows the perceived caloric content of yogurt without a lactose-free claim (A) compared to yogurt with a lactose-free claim (B). It also shows the perceived caloric content of pasta without a gluten-free claim (A) and with a gluten-free claim (B).

According to the results, both products among all three conditions show that the highest percentage of answers chosen was "A and B are equally healthy". Furthermore, the percentage of people perceiving yogurt with a lactose-free claim as having a higher caloric content is higher compared to the percentage of participants perceiving yogurt with a lactose-free claim as having a higher caloric content. Besides, the total percentage of participants perceiving pasta without a gluten-free claim containing more calories is higher than the total percentage of participants perceiving pasta with a gluten-free claim as containing more calories.

As well as for the other three product characteristics, a remarkable point is that the percentages of participants who chose the answer "I do not know" for the perceived caloric content of yogurt is higher compared to the percentage of participants who chose the option "I do not know" for the perceived caloric content of pasta.

The Chi-square test was performed to determine whether or not the three different conditions, symbol, textual claim, or symbol including text had an influence on the answers participants gave regarding the perceived caloric content of yogurt and pasta. The Chi-square test resulted in a p-value of .39, *ns* for the perceived caloric content of yogurt. Regarding the perceived caloric content of pasta, the Chi-square test resulted in a p-value .20, *ns*.

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Table 7: Perceived caloric content of yogurt without a lactose-free claim (A) compared to yogurt with a lactose-free claim (B) and perceived caloric content of pasta without a gluten-free claim (A) compared to pasta with a gluten-free claim (B). The chi-square result is included for the comparison between the different conditions.

Perceived caloric content	Yogurt				Pasta			
	Symbol (%)	Text (%)	Symbol + text (%)	χ^2	Symbol (%)	Text (%)	Symbol + text (%)	χ^2
A contains much more calories	13	9	6	p = .39, *ns*	9	8	4	p = .20, *ns*
A contains somewhat more calories	17	23	14		10	23	18	
A and B have the same caloric content	41	48	60		56	53	63	
B contains somewhat more calories	11	9	7		12	5	6	
B contains much more calories	2	1	2		1	3	2	
I do not know	16	10	11		11	8	6	

To summarize, for both yogurt and pasta among all three conditions the majority of participants chose the option "A and B are equally healthy" or "A and B have the same fat/vitamin/caloric content". Therefore, the majority of people think that yogurt with and without a lactose-free claim and pasta with and without a gluten-free claim have the same product characteristics. Besides, for all product characteristics the percentage of participants who chose the option "I do not know" was higher for yogurt compared to pasta among the three conditions. Lastly, in all cases, the Chi-square results were not statistically significant, except for the perceived vitamin content of yogurt.

4.2.4 Likeliness to buy

After evaluating the product characteristics, pictures of yogurt and pasta with and without a claim were shown to the participants and people had to answer the question: "Imagine you are at the supermarket. How likely would you purchase this product?". This question aimed to examine if people are more likely to buy yogurt and pasta with a lactose-free or gluten-free claim compared to those products without such claims. The likeliness to buy yogurt or pasta with a lactose-free and gluten-free claim was compared to the indicated likeliness to buy the same product without such a claim. In this case, the likeliness to buy ranged from 0 = very unlikely to 10 = very likely. The results from the likeliness to buy a product without a claim compared to a product with a claim can be seen in Table 8. For both yogurt and pasta, the mean of the likeliness that participants will buy such products with and without a symbol, textual claim, or symbol including text is included. The next column includes the difference between the mean of likeliness to buy yogurt and pasta without a claim and the likeliness to buy yogurt and pasta with a claim. In all cases, the mean difference is positive, which means that in all cases the likeliness to buy yogurt and pasta without a claim is higher compared to the likeliness to buy yogurt and pasta with a claim. The correctness of this assumption is confirmed by the Paired Sample T-Test, because in all cases this test resulted in a p-value <.001.

Concerning the results from the One-Way ANOVA, in the case of yogurt, the p-value was significant (p = .05). In the case of pasta, the p-value was not significant (p = .30, *ns*)

Table 8: Likeliness to buy a product without a claim compared to a product with a claim. Chi-square results are included for the comparison between the different conditions.

Likeliness to buy			Mean	Mean difference	Paired Sample T-Test	One-Way ANOVA
Yogurt	Symbol	Without	4,89	1,29	p <.001	p = .05
		With	3,6			
	Text	Without	5,19	2,26	p <.001	
		With	2,93			
	Symbol + text	Without	4,74	1,37	p <.001	
		With	3,37			
Pasta	Symbol	Without	6,87	2,76	p <.001	p = .30, *ns*
		With	4,11			
	Text	Without	6,97	3,45	p <.001	
		With	3,52			
	Symbol + text	Without	6,55	2,73	p <.001	
		With	3,82			

4.2.5 Lactose and gluten content of lactose-free and gluten-free products

The last important question to determine if the consumer perception and intent behaviour could have legal implications was "When this claim is stated on a product, what do you think is the amount of lactose in the product? Write a number in the open space below." The results from the perceived amount of lactose and gluten in a product with a lactose-free or gluten-free claim can be seen in Table 9 and Table 10, respectively.

Table 9: Perceived amount of lactose in a product (mg/100kcal lactose) when a lactose-free claim is stated on a product (test value = 10). The chi-square result is included for the comparison between the different conditions.

Amount of lactose (mg/100 kcal lactose)	Mean	Mean difference	One Sample T-Test	One-Way ANOVA
Symbol	5,21	-4,79	p = .004	p = .29, *ns*
Text	2,68	-7,32	p <.001	
Symbol + text	2,79	-7,21	p <.001	

As can be seen in Table 9, the mean of the perceived amount of lactose in a product, when it claims to be lactose-free using a symbol, textual claim, or symbol including text, does not equal to zero. This means that at some point, people know that there can still be a small amount of lactose in a lactose-free product. However, it should be mentioned that the majority of people think that the amount of lactose in the product is 0 mg/100 kcal lactose, namely 64% of the participants of condition 1 and 70% of the participants of condition 2 and 3.

The perceived amount of lactose was compared to the limit of 10 mg/100kcal lactose, which most of the industry uses as a guideline. This comparison resulted in a negative mean difference. This means that for all three different kinds of lactose-free claims people perceive that there is less lactose in the product than what is allowed. The One Sample T-Test resulted in all cases in a p-value which was significantly different (p = <0.05). When looking at the p-value of the One-Way ANOVA, the value is not statistically significant (p = .29, *ns*).

Table 10: Perceived amount of gluten in a product (mg/kg gluten) when a gluten-free claim is stated on a product (test value = 20). The chi-square result is included for the comparison between the different conditions.

Amount of gluten (mg/kg gluten)	Mean	Mean difference	One Sample T-Test	One-Way ANOVA
Symbol	4,84	-15,16	p <.001	p = .79, *ns*
Text	4,19	-15,81	p <.001	
Symbol + text	3,36	-16,64	p <.001	

As can be seen in Table 10, the mean of the perceived amount of gluten in a product, when it claims to be gluten-free using a symbol, textual claim, or symbol including text, does not equal to zero. So, as in the case of gluten-free claims, people know that there can still be a small amount of gluten in a gluten-free product. However, it should be mentioned that the majority of people think that the amount of gluten in the product is 0 mg/kg gluten, namely 72% of the participants in condition 1, 71% of the participants in condition 2, and 75% of the participants in condition 3.

The perceived amount of gluten was compared to the limit of 20 mg/kg gluten, which is the maximum amount of gluten allowed in a gluten-free product according to the Gluten-Free Food Regulation. This comparison resulted in a negative mean difference. This means that for all three different kinds of gluten-free claims people perceive that there is less gluten in the product than what is allowed. The One Sample T-Test resulted in all cases in a p-value which was significantly different (p = <0.05). When looking at the p-value of the One-Way ANOVA, the value is not statistically significant (p = .79, *ns*).

To summarize, the perceived amount of lactose and gluten in a final product which states to be lactose-free or gluten-free differs from the amount of lactose and gluten that is allowed in such a product. It is remarkable that in majority of the cases, people expect that the amount of lactose and gluten in a lactose-free and gluten-free product is equal to zero.

4.2.6 Factors influencing consumer perception and behaviour intent

Besides questions on the meaning, perceived product characteristics, likeliness to buy, and perceived lactose and gluten content, the questionnaire also includes questions on possible influencing factors. Since there are a lot of factors which could have influenced the results, it is important to control for these factors. This research considered affect, having a food allergy or intolerance, having a family member or good friend with a food allergy or intolerance, consumption behaviour, attitude towards eating healthily, perception of the healthiness of a lactose-free and gluten-free diet, information seeking, and demographics, such as age and gender, as possible influencing factors on the results. The results from those factors are discussed in the next sections. More specific results from those factors can be found in Appendix 1.

Affect

The first possible influencing factor on the results was affect. People were asked to indicate their feelings about lactose and gluten.

According to the results, the majority of people, 34% of condition 1, 45% of condition 2, and 48% of condition 3, provided a score of 5 for their feelings regarding lactose. The score of 5 represents to have neither positive nor negative feelings about lactose. Regarding the other scores, the percentages of participants having negative feelings about lactose are comparable with the percentages of participants having positive feelings about lactose. The Chi-square test provided a p-value of .58, *ns*.

Regarding the results on feelings about gluten of participants, results are similar to the feelings about lactose. The majority of participants answered to have neither positive nor negative feelings on gluten, namely 34% of condition 1, 40% of condition 2, 50% of condition 3. Regarding the other scores, the percentages of participants having negative feelings about gluten are comparable with the percentages of participants having positive feelings about gluten. The Chi-square test for the feelings about gluten resulted in a p-value of .12, *ns*.

Food allergies or intolerances

The second possible influencing factor on the results was whether participants have a food allergy or intolerance or a family member or good friend with a food allergy or intolerance. Since people suffering from a food allergy or intolerance or people who have a family member or good friend with a food allergy or intolerance could have filled in the questionnaire differently, participants were asked if they have a food allergy or intolerance or a good friend or family member with a food allergy or intolerance.

According to the results, 20% of the participants in condition 1, 21% of the participants in condition 2, and 12% of the participants in condition 3 indicated to have a food allergy or intolerance. In Appendix 3 it is specified which food allergies or intolerances participants have. The Chi-square test for the comparison between the three conditions resulted in a p-value .17, *ns*.

Regarding the question if people have a family member or good friend with a food allergy or intolerance 20% of the participants in condition 1, 20% of the participants in condition 2, and 27% of the participants in condition 3 answered this question with “yes”. In Appendix 3 it is specified which food allergies or intolerances family members or good friends of the participants have. The Chi-square test for the comparison between the three conditions resulted in a p-value .45, *ns*.

Consumption behaviour

The third possible influencing factor on the results was the consumption behaviour of the participants. The consumption of yogurt, pasta, lactose-free products (excluding products naturally free of lactose), and gluten-free products (excluding products naturally free of lactose) were measured. Participants had to indicate if they consume those products weekly, monthly, 5-11 times a year, 1-4 times a year or never.

According to the results, the majority of participants among all three conditions consume yogurt and pasta weekly, approximately 70% and 80% respectively. In contrast to the consumption of yogurt and pasta, for the consumption of lactose-free and gluten-free products the majority of participants among all three conditions indicated to never consume those products. For the consumption of lactose-free products approximately 60% of the participants indicated to never consume such products and approximately 65% of the participants indicated to never consume gluten-free products. The Chi-square test for the comparison among the three conditions for the consumption of yogurt, pasta, lactose-free products, and gluten-free products resulted in $p = .023$, $p = .34$, *ns*, $p = .39$, *ns*, and $p = .96$, *ns*, respectively.

Attitudes towards eating healthily

The fourth possible influencing factor on the results was attitude towards eating healthily. Participants were asked to indicate to what extent they agree with the statement 'I attach great value to eating healthily'. Answers ranged from strongly disagree to strongly agree.

Regarding the results, the majority of participants, approximately 60%, among all three conditions agree with the statement. Besides, approximately 30% of the participants among all three groups strongly agree with the statement. The Chi-square test resulted in a p-value of .74, *ns*.

Perception of healthiness of a lactose-free and gluten-free diet

The fifth possible influencing factor on the results was the perception of healthiness of a lactose-free and gluten-free diet. To determine whether this could influence the results, participants had to indicate their perceived healthiness of a lactose-free and gluten-free diet. The answers ranged from very unhealthy (1=0) to very healthy (10).

According to the results, for both diets, the majority of participants answered the question with a score of 5. Concerning the other scores, the percentages of people who perceive a lactose-free or gluten-free diet as unhealthy are comparable to the percentages of people who perceive a lactose-free or gluten-free diet as healthy. The Chi-square test resulted in $p = .45$, *ns* for the perceived healthiness of a lactose-free diet and $p = .68$, *ns* for the perceived healthiness of a gluten-free diet.

Information seeking

The sixth possible influencing factor on the results was information seeking. Information seeking on food packages was measured for four items, namely nutrition information, ingredient list, nutrition claims, and allergy information. Participants had to indicate whether they never, rarely, occasionally, often, or always look at this information.

According to the results, the majority of people (approximately 40%) among all three conditions look often at nutrition information. Most of the people among all three conditions do occasionally or often look at the ingredient list, approximately 40% and 30% respectively. Besides, most of the people (approximately 30%) look occasionally at nutrition claims. In contrast to the other items, the majority of people do never (approximately 35%) or rarely (approximately 30%) look at allergy information. The Chi-square test for the comparison among the three conditions for information seeking on nutrition information, ingredient list, nutrition claims, and allergy information resulted in $p = .97$, *ns*, $p = .32$, *ns*, $p = .35$, *ns*, and $p = .48$, *ns* respectively.

Sociodemographic information

The last possible influencing factor on the results was sociodemographic information. This includes age, gender, highest level of school completed, country in which the participant currently live, and country of origin. The results of these factors are summarized below.

In each condition, the majority of participants were women (approximately 60%). Most of the people had an age range between 18-24 and had a bachelor's degree as the highest level of school completed. Furthermore, in each condition, approximately 95% of the participants are currently living in The Netherlands, which is also their country of origin. The result from the Chi-square test for gender was $p = .34$, *ns*. For age the Chi-square test was $p = .58$, *ns*. Concerning the highest level of school completed, the country in which you currently live, and country of origin the results from the Chi-square test were $p = .52$, *ns*, $p = .16$, *ns*, and $p = .69$, *ns* respectively.

Summarizing, most of the people neither have positive nor negative feelings about lactose and gluten. Approximately 20% of the participants have a food allergy or intolerance. Besides, approximately 20% of the participants have a family member or good friend with a food allergy or intolerance for who they need to buy food products. Furthermore, among all three conditions the majority of people consume yogurt and pasta weekly. Regarding the statement "I attach great value to eating healthily" the majority of participants agree with this statement. Moreover, participants perceive the healthiness of a lactose-free and gluten-free diet as neither unhealthy nor healthy. Concerning information seeking, most participants often look at nutrition information and the ingredient list, they look occasionally at nutrition claims, and they rarely to never look at allergy information. Lastly, results on sociodemographic information show that the majority of participants are women, have an age range between 18-24, mostly have a

bachelor's degree, and are living and originally coming from The Netherlands. All results from the Chi-square show a non-significant p-value, except for the consumption of yogurt.

4.3 Discussion of the results

The experiment aimed to investigate what the consumer perception and behaviour intent are regarding lactose-free and gluten-free textual claims, symbols, and symbols including text. The results from each question of the questionnaire are discussed below. Besides, the results of the lactose-free claims are compared to the results of the gluten-free claims and some recommendations for further research are given.

4.3.1 Meaning of lactose-free and gluten-free claims

Regarding the meaning of lactose-free and gluten-free claims, the experiment shows some interesting results. The p-value of the Chi-square test was for both claims statistically significant ($p = <.001$). This means that the condition, symbol, textual claim, or symbol including text, had a significant effect on whether a definition was good or wrong. According to the results, a lactose-free or gluten-free symbol including text resulted in the highest percentage of good definitions.

4.3.2 Perceived product characteristics

Concerning the perceived product characteristics, results from the experiment show that in majority of the cases, yogurt with and without a lactose-free claim and pasta with and without a gluten-free claim were perceived as having the same product characteristics. For all product characteristics, healthiness, fat content, vitamin content, and caloric content, the p-values of the Chi-square test were not statistically significant, except for the vitamin content of yoghurt. This means that the condition did not influence the perceptions of the participants. These results from the experiment are contradicting to the results from the studies as discussed in Chapter 3, which had shown that consumers perceive products with lactose-free and gluten-free claims as healthier and less caloric. It seems that in this experiment the majority of participants evaluated the product characteristics of yogurt with and without a lactose-free claim correctly since the advantages of reduced lactose or lactose-free dairy products are not likely to have a different nutritional effect on the human body compared to normal dairy products (Dekker, Koenders & Bruins, 2019).

However, in contrast to the perceived product characteristics of yogurt with and without a lactose-free claim, the evaluation of product characteristics of pasta with and without a gluten-free claim of participants seems to be wrong. In the majority of cases, participants thought pasta with and without a gluten-free claim are equally healthy and have the same fat, vitamin, and caloric content. On the one hand, it can be argued that this is not true, because recent studies show that a gluten-free diet is associated with an increased calorie and fat intake and deficiencies in minerals and vitamins (Miranda et al., 2014; Wu et al., 2015). On the other hand,

those studies were on a gluten-free diet and not specifically on the pasta that was shown to the participants in the experiment. Assuming that the pasta with the gluten-free claim that was shown to the participants contains more calories and fat and fewer vitamins compared to the pasta without the gluten-free claim, it seems that participants did not evaluate the product characteristics correctly. Therefore, even though results are not in line with previous studies, it can be stated that participants at least perceive pasta with a gluten-free claim as healthier, as containing less fat and calories, and as containing more vitamins compared to the actual product characteristics of the gluten-free pasta.

The other remarkable point is that according to the results the percentage of participants that chose the option "I do not know" was for all product characteristics higher for yogurt compared to pasta. It is unclear whether this difference is caused by the fact that people did not know the answer because nutrition declaration information was missing, or they really did not know the answer.

4.3.3 Likeliness to buy

The likeliness to buy was measured to determine whether participants were more likely to buy products with a lactose-free or gluten-free claim compared to products without a lactose-free or gluten-free claim. For both products, among all three conditions, the Paired Sample T-Test resulted in p-values which were significant ($p < .001$). This means that in all cases participants were more likely to buy yogurt or pasta without a lactose-free or gluten-free claim compared to yogurt and pasta with such claims.

A One-Way ANOVA was done to examine if the conditions could have an influence on the difference of likeliness to buy yogurt with and without a lactose-free claim and pasta with and without a gluten-free claim. In the case of yogurt, the p-value was significant (.05), which means that the condition had a significant influence on the difference between the likeliness to buy yogurt without and with a lactose-free claim. It seems that participants, to whom the lactose-free textual claim was shown, have an even higher preference for yogurt without such claim compared to the preference of participants for yogurt without a lactose-free symbol or symbol including text. In the case of pasta, the p-value was not significant, which means that the condition did not have an effect on the difference between the likeliness to buy pasta without and with a gluten-free claim.

4.3.4 Perceived lactose and gluten content

Another interesting result from the experiment is the perceived amount of lactose and gluten in a product which stated to be lactose-free or gluten-free. The One Sample T-Test for both claims resulted in all cases in a significant p-value. This means that the perceived amount of lactose and gluten in the product is significantly different from the amount of lactose and gluten that is allowed in the product. According to the results from the One-Way ANOVA the condition did not influence the perceived amount of lactose and gluten in a lactose-free or gluten-free product. Moreover, it seems that participants believe that free-from literally means free-from, since the

majority of participants think that a lactose-free product contains 0 mg/100 kcal lactose and that a gluten-free product contains 0 mg/kg gluten.

4.3.5 Possible influencing factors

Since there are a lot of factors that could influence the results, the experiment tried to control those influencing factors as much as possible. This research considered affect, having a food allergy or intolerance, having a family member or good friend with a food allergy or intolerance, consumption behaviour, attitude towards eating healthily, perception of the healthiness of a lactose-free and gluten-free diet, information seeking, and demographics, such as age and gender, as possible influencing factors on the results. According to results presented in Appendix 1, there is one factor that could have influenced the results, namely the consumption of yogurt, which was significantly different among the three groups. However, the biggest difference among the three groups seems to be in percentages of people who consume yogurt weekly and people who consume yogurt monthly. So, it seems that the percentage of people in one group never consuming yogurt is much higher compared to other groups. They are at least familiar with yogurt, so the influence of this significant difference between the three groups is probably very small.

4.3.6 Comparison lactose-free and gluten-free claims

After analysing data and discussing the results of the experiment, lactose-free and gluten-free claims can be compared to each other. According to the results from the experiment, the different types of claims are treated very similarly. The type of claim had only an influence on the given meaning to lactose-free and gluten-free claims and on the likeliness to buy yogurt with a lactose-free claim compared to yogurt without a lactose-free claim. When considering which claim is the best option to present on a gluten-free or lactose-free product this seems to be the symbol including text for both claims.

According to the results from the literature research and the experiment, the consumer perception and intent behaviour regarding lactose-free claims compared to gluten-free claims seems to not differ that much from each other. From a legal perspective, this is an interesting finding. If those claims are treated similarly, this could mean that those claims should have similar legislation.

4.3.7 Recommendations further research

If further research in this field will be performed, the experiment can be improved the in the following way: firstly, a bigger sample size will lead to more reliable results. Furthermore, this experiment is on European legislation. Since the majority of people participating in this experiment were living in The Netherlands, it will be better to execute such an experiment in multiple countries to better generalize results from participants of the studies to the European citizens. Secondly, the lactose-free and gluten-free claims were only presented on yogurt or pasta. The perceived product characteristics are probably dependent on products that are shown

to the participants. To provide more evidence showing that lactose-free and gluten-free claims can be misleading, regarding related product characteristics, further research should include more diverse products which include the representation of these claims. Thirdly, according to the comments given at the end of the questionnaire, a few people indicated that pictures of the lactose-free and gluten-free claims presented on yogurt and pasta were not clearly visible, in particular on a mobile phone on which it was not possible to zoom in. To prevent this problem in the future, it is suggested to do further research on a computer or use another software program for the questionnaire where people can zoom in on the images.

5. Discussion

This research aimed to investigate what the consumer perception and behaviour intent are regarding lactose-free and gluten-free textual claims, symbols, and symbols including text. In the next paragraphs results from this research will be discussed to determine if the results could have legal implications. Thereafter, the strengths and limitations of this research will be discussed.

5.1 Objectives EU legislation

As elaborated in Chapter 2, the FIR is the overarching legislation for lactose-free and gluten-free claims. One of the provisions of that Regulation is to ensure a high level of consumer protection concerning food information, taking into account the differences in perception of consumers and information they need. According to the results from the experiment, it seems to be doubtful if this a high level of consumer protection is ensured concerning food information. The reasons why this seems to be doubtful are discussed in the next few paragraphs.

First of all, regarding the results from the experiment on the meaning of lactose-free and gluten-free claims, it seems that symbols are not clear and understandable for the consumer. Furthermore, these symbols seem to confuse and mislead the consumer. As can be seen in Appendix 2 people provided a lot of different definitions for those symbols of which a lot of definitions were wrong. Therefore, it seems that people do not know what those claims mean and those claims seem to be difficult to understand for the consumer. Moreover, people think the product has characteristics which it does not possess. Consequently, there is a possibility that lactose-free and gluten-free symbols are not clear and understandable for the consumer and are possibly confusing and misleading to the consumer.

Second, according to results from the literature research, a food product with a lactose-free claim is perceived as healthier. This may be used as evidence to show that the lactose-free claim can possibly be misleading. However, according to the results from the experiment, the majority of participants thought that yogurt with and without a symbol, textual claim, or symbol including text were equally healthy and having the same fat, vitamin and caloric content. Since the advantages of reduced lactose or lactose-free dairy products are not likely to have a different nutritional effect on the human body compared to normal dairy products, it seems that people gave in the majority of cases the correct answer and therefore are not misleading to the consumer (Dekker, Koenders & Bruins, 2019).

In contrast to lactose-free claims, according to the results from the literature research and experiment, gluten-free claims seem to possibly be misleading to consumers regarding the related product characteristics. The results from the literature research show that gluten-free claims were perceived as healthier and less caloric (Priven et al. ,2015; Hartman et al., 2018; Prada, Garrido & Rodrigues, 2019). Even though results from the experiment were not in line

with previous studies, it can be stated that participants at least perceive pasta with a gluten-free claim as healthier, as containing less fat and calories, and as containing more vitamins compared to the actual product characteristics of gluten-free pasta. Since the results from the experiment and literature research show that people think a gluten-free product has characteristics, which in fact it does not possess, these results may be used as evidence to show that gluten-free claims are possibly misleading.

Lastly, data from the experiment shows that the majority of participants think that a product with a lactose-free or gluten-free claim contains 0 mg/100kcal lactose and 0 mg/kg gluten. However, those properties are falsely attributed, since products are allowed to have 20 mg/kg gluten in a gluten-free product and for lactose-free products there is not even a set limit, except for infant formula which is 10 mg/100kcal lactose. Since participants think that the product has certain characteristics which it does not possess, the results from the experiment may be used as evidence to show that lactose-free and gluten-free claims are possibly misleading regarding product characteristics.

Besides, as discussed in Chapter 2 the FIR is complementing the UCPD. In contrast to the FIR, under the UCPD something can only be seen as misleading if it also causes a transactional decision which an average consumer would not have taken otherwise. According to the results from the experiment, people are more likely to buy yogurt without a lactose-free claim and pasta without a gluten-free claim. Therefore, it seems to not be likely that those claims can cause a transactional decision which an average consumer would not have taken otherwise. For that reason, lactose-free and gluten-free claims cannot be considered as misleading under the UCPD.

Taken together, according to this experiment, lactose-free and gluten-free claims cannot be seen as misleading under the UCPD since the part on the likeliness to take a transactional decision which a consumer would not have taken otherwise is missing. Nevertheless, results from the experiment may be used as evidence to show that some amendments to the legislation applicable to lactose-free and gluten-free claims are needed in order better achieve the provisions of the FIR.

If the evidence provided by this research and other studies can convince the European Commission that legislation applicable to lactose-free and gluten-free claims need to be improved, this can lead to amendments in the current legislation or they can set up new legislation. Therefore, the consumer perception and intent behaviour regarding lactose-free and gluten-free claims may have legal implications.

5.3 Strengths of the study

One of the strengths of this research is that it includes the perception and intent behaviour of different types of lactose-free and gluten-free claims. In this case, it can be stated whether the effect on the perception and intent behaviour was caused by the symbol, textual claim, or symbol including text. Furthermore, to our knowledge this is the first study that assessed the consumer perception and intent behaviour regarding lactose-free and gluten-free claims to determine whether this could have legal implications. This might provide people in the field in food law with new insights and ideas.

5.4 Limitations of the study

Despite this experiment providing some interesting results that may be used as evidence to show that lactose-free and gluten-free claims can be misleading, ambiguous, confusing, and are possibly not clear and easy to understand for consumers, this research has two big limitations.

Firstly, the results from the questionnaire cannot be generalized to all European citizens, since the majority of people participating in this experiment are from The Netherlands. Therefore, it will be better to execute such an experiment in multiple countries to better generalize results from participants of the studies to the European citizens.

Secondly, this research was only able to provide evidence to show that the consumer perception and intent behaviour regarding lactose-free and gluten-free claims may have legal implications. However, this study was not able to state with certainty that this could have legal implications. The main reason therefore is that national authorities and courts have to fill the average consumer with meaning to determine whether something can be seen as misleading. Besides, this study was not able to determine what the legal implications are. Based on the results of this research, only some recommendations are provided, which are discussed in the next chapter.

6. Conclusion and recommendations

The first section of this chapter will provide the conclusion of this research. The second section of this chapter will provide some recommendations to better achieve the objective of the FIR.

6.1 Conclusion

The objective of this thesis was to find what the consumer perception and intent behaviour is regarding lactose-free and gluten-free claims and if this could have legal implications. For this purpose, the following sub-questions have been addressed in this thesis:

1. How are making lactose-free and gluten-free claims on food products currently regulated at EU level?
2. What is scientifically known about the consumer perception of lactose-free and gluten-free claims?
3. What is the consumer perception of gluten-free and lactose-free claims?
4. What are the consumer perception and intent behaviour regarding of products with gluten-free and lactose-free claims?
5. Could the consumer perception and intent behaviour regarding lactose-free and gluten-free claims have legal implications?

Information from legal texts and scientific literature and results from an own experiment have been used to answer these sub-questions.

Concerning lactose-free and gluten-free claims, under the current legal framework three different regulations are applicable. The overarching legislation for lactose-free and gluten-free claims is the FIR. Most importantly, according to this legislation lactose-free and gluten-free claims shall be clear, accurate and easy to understand for the consumer. Furthermore, those claims shall not be misleading, ambiguous, or confusing. More specific rules on gluten-free claims are set out by the Gluten-Free Food Regulation. For lactose-free claims there is no clear legislation, except for infant formula and follow-on formula. Rules on using a lactose-free claim on infant formula or follow-on formula are set out by the Infant Formula and Follow-On Formula Regulation. Most of the industry uses the limit as specified by this Regulation as a guideline for other products.

Based on the method used for the literature review of this research, there were three studies found investigating the effect of lactose-free and gluten-free claims on the consumer perception. Concerning lactose-free and gluten-free symbols including text, two studies concluded that people perceive products with those claims as healthier. Furthermore, consumers did not only perceive a product with a gluten-free symbol including text as healthier, but also as less caloric and less processed. Regarding gluten-free textual claims, there was one study found investigating the effect of such a claim on consumer perception and concluded that a product with such a claim was perceived as healthier. No studies were found investigating the effect of a lactose-free textual claim and lactose-free and gluten-free symbols.

To provide more data on the actual consumer perception and intent behaviour regarding lactose-free and gluten-free claims, especially for lactose-free and gluten-free symbols, and lactose-free textual claims, this research set up an experiment. From the results can be concluded that the type of claim had a significant effect on the percentage of good definitions of lactose-free and gluten-free claims. A symbol including text resulted in the highest percentage of good definitions given to both claims among the three conditions. Concerning product characteristics, the majority of people think that products with and without a lactose-free or gluten-free claim have the same product characteristics. Regarding the likeliness to buy a product with or without a claim, people are significantly more likely to buy yogurt and pasta without a lactose-free and gluten-free claims compared to yogurt and pasta with lactose-free and gluten-free claims. Concerning the perceived amount of lactose and gluten in a lactose-free or gluten-free product, the perceived amount is significantly different from the amount of lactose and gluten that is allowed in such a product. It is remarkable that in the majority of cases, people expect that the amount of lactose and gluten in a lactose-free and gluten-free product should be zero. Overall, lactose-free and gluten-free products seem to be treated very similarly and the type of claim also seems to have little influence on the consumer perception and intent behaviour.

To conclude, the results from this research may be used as evidence to show that lactose-free and gluten-free claims are possibly misleading, ambiguous, confusing, not clear, and not easy to understand for the consumer. If further research will show the same results, this can result in some legal implications.

6.2 Recommendations

According to the results from the experiment, it seems to be doubtful if a high level of consumer protection is ensured as specified by the FIR regarding lactose-free and gluten-free claims. In order to better achieve the objective of the FIR, this section provides some recommendations.

First, it is recommended to set up clear legislation for lactose-free claims. Without legislation on when it is allowed to use a lactose-free claim, consumers, especially people with a lactose intolerance, are not sufficiently protected. When legislation is established on the maximum allowable amount of lactose in a lactose-free product, it is clearer for the industry if they can use this claim and other parties can better control for compliance. Considering that the results from the experiment of this research show that gluten-free and lactose-free claims are treated similarly, there is also a possibility to combine rules on those claims in a so-called ‘free-from’ legislation.

Second, it should be considered to adjust the claims lactose-free and gluten-free. As discussed in Chapter 3, the study of Priven et al. (2015) demonstrates that textual claims stating that a product is free-from a certain ingredient can result in perceiving a product as healthier. Furthermore, the study of Prada et al. (2018) shows that a gluten-free symbol including text does not only result in perceiving a product as healthier but also as less caloric and less processed. A possible explanation for those findings is the halo effect. If it is the case that ‘free from’ labelling can cause the halo effect, this effect could be avoided by adjusting the lactose-

free and gluten-free claims and changing it to ‘very low gluten/lactose’ and ‘low gluten/lactose’.

Third, it should be considered to make the claims lactose-free and gluten-free more accurate. Accuracy was not covered by the experiment, but some improvements in accuracy can possibly help consumers to better understand lactose-free and gluten-free claims and therefore may be less misleading. Those claims can be made more accurately by, for instance, complementing the claim gluten-free by the statement ‘most people can safely consume gluten’. In that case, consumers should understand that gluten-free products are unlikely to provide health benefits compared to conventional products.

Finally, according to the results from the experiment, most people understand the meaning of a lactose-free and gluten-free claim in the case of a symbol including text. To comply with the objective of the FIR that differences in perception of consumers and information they need should be taken into account, it is suggested to always use a combination of the symbol and text. In this case, besides that ‘normal’ people will understand this kind of claim better, people who have difficulties with reading or even are illiterate are also taken into account.

Since this thesis only provides some evidence that it seems to be doubtful if a high level of consumer protection is ensured as specified by the FIR regarding lactose-free and gluten-free claims, more evidence is needed to prove that. If further research proves that legislation needs to be improved, it will be interesting to investigate if the above-mentioned recommendations will help to improve the current legislation.

Although this study did not prove that legislation applicable to lactose-free and gluten-free claims need to be amended, this study, hopefully, contributes to the knowledge on how people perceive lactose-free and gluten-free claims in order to help to improve current legislation.

References

Allen, K. J., & Koplin, J. J. (2012). The epidemiology of IgE-mediated food allergy and anaphylaxis. *Immunology and Allergy Clinics*, *32*(1), 35-50.

Allen, K. J., Turner, P. J., Pawankar, R., Taylor, S., Sicherer, S., Lack, G., ... & Beyer, K. (2014). Precautionary labelling of foods for allergen content: are we ready for a global framework? *World Allergy Organization Journal*, *7*(1), 1.

Allergenen Consultancy (n.d.). Lactosevrij produceren van voedingsmiddelen. Retrieved on 23rd of September 2019 from: https://www.allergenenconsultancy.nl/lactosevrij

Asioli, D., Aschemann-Witzel, J., Caputo, V., Vecchio, R., Annunziata, A., Næs, T., & Varela, P. (2017). Making sense of the "clean label" trends: A review of consumer food choice behavior and discussion of industry implications. *Food Research International*, *99*, 58-71.

Bardella, M. T., Fredella, C., Saladino, V., Trovato, C., Cesana, B. M., Quatrini, M., & Prampolini, L. (2005). Gluten intolerance: gender-and age-related differences in symptoms. *Scandinavian journal of gastroenterology*, *40*(1), 15-19.

Barnett, J., Muncer, K., Leftwich, J., Shepherd, R., Raats, M. M., Gowland, M. H., ... & Lucas, J. S. (2011). Using 'may contain' labelling to inform food choice: a qualitative study of nut allergic consumers. *BMC public health*, *11*(1), 734.

British Retail Consortium (BRC) & Food and Drink Federation (FDF) (2015). Guidance on "free-from" allergen claims. Retrieved on 23rd of September 2019 from: https://www.fdf.org.uk/corporate_pubs/brc-free-from-guidance.pdf

Buttriss, J. (Ed.). (2008). *Adverse reactions to food: The report of a British nutrition foundation task force*. John Wiley & Sons.

Confusing (2008). In *Cambridge advanced learner's dictionary* (3rd ed.). Retrieved from https://dictionary.cambridge.org/dictionary/english/confusing

Accurate (2008). In *Cambridge advanced learner's dictionary* (3rd ed.). Retrieved from https://dictionary.cambridge.org/dictionary/english/accurate

Clear (2008). In *Cambridge advanced learner's dictionary* (3rd ed.). Retrieved from https://dictionary.cambridge.org/dictionary/english/clear

Understand (2008). In *Cambridge advanced learner's dictionary* (3rd ed.). Retrieved from https://dictionary.cambridge.org/dictionary/english/understand

Carreño, I., & Vergano, P. (2014). Uses and potential abuses of "negative claims" in the EU: the urgent need for better regulation. *European Journal of Risk Regulation*, *5*(4), 469-490

Carrillo, E., Fiszman, S., Lähteenmäki, L., & Varela, P. (2014). Consumers' perception of symbols and health claims as health-related label messages. A cross-cultural study. *Food Research International*, *62*, 653-661

Case C-210/96 Gut Springenheide and Tusky v Oberkreisdirektor Steinfurt [1998] ECR I-4657

Christoph, M. J., Larson, N., Hootman, K. C., Miller, J. M., & Neumark-Sztainer, D. (2018). Who values gluten-free? Dietary intake, behaviours, and sociodemographic characteristics of young adults who value gluten-free food. *Journal of the Academy of Nutrition and Dietetics*, *118*(8), 1389-1398.

Commission Delegated Regulation (EU) 2016/127 of 25 September 2015 supplementing Regulation (EU) No 609/2013 of the European Parliament and of the Council as regards the specific compositional and information requirements for infant formula and follow-on formula and as regards requirements on information relating to infant and young child feeding *OJ L 25, 2.2.2016, p. 1–29.*

Commission Implementing Regulation (EU) No 828/2014 of 30 July 2014 on the requirements for the provision of information to consumers on the absence or reduced presence of gluten in food *OJ L 228, 31.7.2014, p. 5–8.*

Commission Regulation (EC) No 41/2009 of 20 January 2009 concerning the composition and labelling of foodstuffs suitable for people intolerant to gluten *OJ L 16, 21.1.2009, p. 3–5.*

Dean, M., Shepherd, R., Arvola, A., Vassallo, M., Winkelmann, M., Claupein, E., ... & Saba, A. (2007). Consumer perceptions of healthy cereal products and production methods. *Journal of Cereal Science*, *46*(3), 188-196.

Dekker, P. J., Koenders, D., & Bruins, M. J. (2019). Lactose-free dairy products: Market developments, production, nutrition and health benefits. *Nutrients*, *11*(3), 551

Directive 2005/29/EC of the European Parliament and of the Council of 11 May 2005 concerning unfair business-to-consumer commercial practices in the internal market and amending Council Directive 84/450/EEC, Directives 97/7/EC, 98/27/EC and 2002/65/EC of the European Parliament and of the Council and Regulation (EC) No 2006/2004 of the European Parliament and of the Council ('Unfair Commercial Practices Directive') *OJ L 149, 11.6.2005, p. 22–39.*

DunnGalvin, A., Chan, C. H., Crevel, R., Grimshaw, K., Poms, R., Schnadt, S., ... & Baka, A. (2015). Precautionary allergen labelling: perspectives from key stakeholder groups. *Allergy*, *70*(9), 1039-1051.

European Commission (2016). Commission staff working document: guidance on the implementation/application of Directive 2005/29/EC on unfair commercial practices, p. 37-42.

Foucard, T., & Malmheden Yman, I. (1999). A study on severe food reactions in Sweden–is soy protein an underestimated cause of food anaphylaxis? *Allergy*, *54*(3), 261-265.

Gaesser, G. A., & Angadi, S. S. (2012). Gluten-free diet: Imprudent dietary advice for the general population?. *Journal of the Academy of Nutrition and Dietetics*, *112*(9), 1330-1333.

Gekas, V., & Lopez-Leiva, M. (1985). Hydrolysis of lactose: A literature review. *Process biochemistry*, *20*(1), 2-12.

Hartmann, C., Hieke, S., Taper, C., & Siegrist, M. (2018). European consumer healthiness evaluation of 'Free-from' labelled food products. *Food quality and preference*, *68*, 377-388.

Kapsak, W. R., Schmidt, D., Childs, N. M., Meunier, J., & White, C. (2008). Consumer perceptions of graded, graphic and text label presentations for qualified health claims. *Critical reviews in food science and nutrition*, *48*(3), 248-256.

Law, J. (2018). A Dictionary of Law. Meaning of ambiguity. *Oxford University Press*. Retrieved 20th of October 2019 from: https://www.oxfordreference.com/view/10.1093/acref/9780198802525.001.0001/acref-9780198802525-e-187?rskey=seWsgl&result=213

Levy, J., Bernstein, L., & Silber, N. (2014). Celiac disease: an immune dysregulation syndrome. *Current problems in pediatric and adolescent health care*, *44*(11), 324-327.

Loh, W., & Tang, M. (2018). The epidemiology of food allergy in the global context. *International journal of environmental research and public health*, *15*(9), 2043.

Meisterernst, A., & Haber, B. (2007). The silent Revolution-Legal Overview on Regulation (EC) 1924/2006 on Nutrition and Health Claims. *Eur. Food & Feed L. Rev.*, *2*, 339.

Menger-Ogle, A. D., & Graham, D. J. (2018). The influence of front-of-package nutrition claims on food perceptions and purchase intentions among Nepali consumers. *Food quality and preference*, *66*, 160-170.

Messer, K. D., Costanigro, M., & Kaiser, H. M. (2017). Labeling food processes: the good, the bad and the ugly. *Applied Economic Perspectives and Policy*, *39*(3), 407-427.

Miranda, J., Lasa, A., Bustamante, M. A., Churruca, I., & Simon, E. (2014). Nutritional differences between a gluten-free diet and a diet containing equivalent products with gluten. *Plant foods for human nutrition*, *69*(2), 182-187.

Osborne, N. J., Koplin, J. J., Martin, P. E., Gurrin, L. C., Lowe, A. J., Matheson, M. C., ... & Allen, K. J. (2011). Prevalence of challenge-proven IgE-mediated food allergy using population-based sampling and predetermined challenge criteria in infants. *Journal of Allergy and Clinical Immunology*, *127*(3), 668-676.

Pascual, C. Y., Crespo, J. F., Perez, P. G., & Esteban, M. M. (2000). Food allergy and intolerance in children and adolescents, an update. *European journal of clinical nutrition*, *54*(S1), S75

Prada, M., Garrido, M. V., & Rodrigues, D. (2017). Lost in processing? Perceived healthfulness, taste and caloric content of whole and processed organic food. *Appetite*, *114*, 175-186

Priven, M., Baum, J., Vieira, E., Fung, T., & Herbold, N. (2015). The influence of a factitious free-from food product label on consumer perceptions of healthfulness. *Journal of the Academy of Nutrition and Dietetics*, *115*(11), 1808-1814.

Radam, A., Yacob, M. R., Bee, T. S., & Selamat, J. (2010). Consumers' perceptions, attitudes and willingness to pay towards food products with" No Added Msg" labelling. *International Journal of Marketing Studies*, *2*(1), 65-77.

Regulation (EU) 2017/1001 of the European Parliament and of the Council of 14 June 2017 on the European Union trademark *OJ L 154, 16.6.2017,* p. 1–99.

Regulation (EU) No 609/2013 of the European Parliament and of the Council of 12 June 2013 on food intended for infants and young children, food for special medical purposes, and total diet replacement for weight control and repealing Council Directive 92/52/EEC, Commission Directives 96/8/EC, 1999/21/EC, 2006/125/EC and 2006/141/EC, Directive 2009/39/EC of the European Parliament and of the Council and Commission Regulations (EC) No 41/2009 and (EC) No 953/2009 *OJ L 181, 29.6.2013,* p. 35–56.

Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers, amending Regulations (EC) No 1924/2006 and (EC) No 1925/2006 of the European Parliament and of the Council, and repealing Commission Directive 87/250/EEC, Council Directive 90/496/EEC, Commission Directive 1999/10/EC, Directive 2000/13/EC of the European Parliament and of the Council, Commission Directives 2002/67/EC and 2008/5/EC and Commission Regulation (EC) No 608/2004 *OJ L 304, 22.11.2011, p. 18–63.*

Regulation (EC) No 1924/2006 of the European Parliament and of the Council of 20 December 2006 on nutrition and health claims made on foods *OJ L 404, 30.12.2006*, p. 9–25.

Sampson, H. A. (2004). Update on food allergy. *Journal of allergy and clinical immunology*, *113*(5), 805-819.

Schebesta, H., & Purnhagen, K. P. (2019). An average consumer concept of bits and pieces-Empirical evidence on the Court of Justice of the European Union's concept of the average consumer in the UCPD. In Micklitz, H.W., De Almeida, L., Cantero Gamito, M. (Eds.), *The Transformation of Economic Law: Essays in Honour of Hans-W. Micklitz* (p. 13-27). Retrieved from http://web.a.ebscohost.com.ezproxy.library.wur.nl/ehost/ebookviewer/ebook/bmxlYmtfXzIxOTYxNzFfX0FO0?sid=9c6dc4d0-d0dd-4494-b155-09f9121b1887@sessionmgr4006&vid=0&format=EB&lpid=lp_11&rid=0

Sicherer, S. H., & Sampson, H. A. (2006). 9. Food allergy. *Journal of Allergy and Clinical Immunology*, *117*(2), S470-S475.

Suchy, F. J., Brannon, P. M., Carpenter, T. O., Fernandez, J. R., Gilsanz, V., Gould, J. B., ... & Miller, N. J. (2010). National Institutes of Health consensus development conference: lactose intolerance and health. *Annals of internal medicine*, *152*(12), 792-796

Swagerty, D. L., Walling, A. D., & Klein, R. M. (2002). Lactose intolerance. *American family physician*, *65*(9), 1845-1860.

Urala, N., Arvola, A., & Lähteenmäki, L. (2003). Strength of health-related claims and their perceived advantage. *International journal of food science & technology*, *38*(7), 815-826

Vesa, T. H., Marteau, P., & Korpela, R. (2000). Lactose intolerance. *Journal of the American College of Nutrition*, *19*(sup2), 165S-175S.

Wieser, H. (2007). Chemistry of gluten proteins. *Food microbiology*, *24*(2), 115-119.

Wu, J. H., Neal, B., Trevena, H., Crino, M., Stuart-Smith, W., Faulkner-Hogg, K., ... & Dunford, E. (2015). Are gluten-free foods healthier than non-gluten-free foods? An evaluation of supermarket products in Australia. *British Journal of Nutrition*, *114*(3), 448-454.

Appendix 1

Table 11: Factors which could have an influence on the perception of lactose-free and gluten-free claims. For each level of answers, the proportion is included. Chi square results corresponding to each variable are shown. Condition 1 comprised 109 people (36%), condition 2 comprised 100 people (33%), and condition 3 comprised 94 people (31%).

Variable	χ^2	Level	n	% condition 1	% condition 2	% condition 3
Gender	p = .34, *ns*	Man	111	33	41	37
		Woman	188	66	58	62
		Other	2	1	1	0
		Prefer not to answer	2	0	0	2
Age	p = .58, *ns*	18-24	103	36	30	36
		25-34	35	10	11	14
		35-44	45	14	20	11
		45-54	77	26	27	23
		55-64	30	9	7	14
		Older than 64	12	6	4	2
		Prefer not to answer	1	0	1	0
Highest level of school completed	p = .52, *ns*	Primary school	2	0	1	1
		High school graduate	24	9	5	10
		Associate degree in college	54	16	21	17
		Bachelor's degree in college	145	49	48	47
		Master's degree	70	21	25	23
		Doctoral degree	6	4	0	2
		Prefer not to answer	2	2	0	0
Country in which you currently live	p = .16, *ns*	Belgium	2	0	2	0
		Bulgaria	0	0	0	0
		Croatia	0	0	0	0
		Cyprus	1	0	1	0
		Denmark	0	0	0	0
		Germany	1	0	0	1
		Estonia	0	0	0	0
		Finland	0	0	0	0
		France	0	0	0	0
		Greece	0	0	0	0
		United Kingdom	0	0	0	0
		Hungary	0	0	0	0
		Ireland	2	0	0	2

Variable	χ^2	Level	n	% condition 1	% condition 2	% condition 3
		Italy	0	0	0	0
		Latvia	0	0	0	0
		Lithuania	0	0	0	0
		Luxemburg	0	0	0	0
		Malta	0	0	0	0
		The Netherlands	295	99	97	96
		Austria	1	0	0	1
		Poland	0	0	0	0
		Portugal	0	0	0	0
		Romania	0	0	0	0
		Slovenia	0	0	0	0
		Slovakia	0	0	0	0
		Spain	0	0	0	0
		Czech Republic	0	0	0	0
		Sweden	0	0	0	0
		Not EU country	0	0	0	0
		I prefer not to answer	1	1	0	0
Same as country of origin	p = .69, *ns*	yes	284	94	94	94
		no	18	6	5	6
		prefer not to answer	1	0	1	0
Having an allergy or intolerance yourself	p = .17, *ns*	yes	54	20	21	12
		no	249	80	79	88
Having a family member or good friend with an allergy or intolerance	p = .45, *ns*	yes	67	20	20	27
		no	236	80	80	73
Perceived healthiness lactose-free diet	p = .45, *ns*	0 = very unhealthy	5	1	2	2
		1	4	2	1	1
		2	13	2	4	7
		3	24	9	9	5
		4	29	14	5	10
		5	131	41	41	48
		6	47	11	21	15
		7	27	13	7	6
		8	11	4	4	3
		9	5	2	3	0
		10 = very healthy	7	2	3	2
Perceived healthiness gluten-free diet	p = .68, *ns*	0 = very unhealthy	13	2	8	3

Variable	χ^2	Level	n	% condition 1	% condition 2	% condition 3
		1	6	3	2	1
		2	17	5	6	6
		3	26	10	8	7
		4	30	13	6	11
		5	127	41	39	46
		6	38	11	15	12
		7	27	11	7	9
		8	9	2	3	4
		9	5	2	3	0
		10 = very healthy	5	1	3	1
Attached great value to eating healthily	p = .74, *ns*	strongly disagree	6	2	1	3
		disagree	3	0	2	1
		neither agree nor disagree	27	6	10	11
		agree	177	60	58	57
		strongly agree	90	32	29	28
Looking at nutrition information	p = .97, *ns*	never	37	12	11	14
		rarely	37	11	13	13
		occasionally	76	26	28	21
		often	129	42	40	46
		always	24	9	8	6
Looking at ingredient list	p = .32, *ns*	never	22	7	8	7
		rarely	42	20	10	14
		occasionally	118	31	44	39
		often	94	33	27	31
		always	27	8	11	9
Looking at nutrition claims	p = .35, *ns*	never	52	15	18	19
		rarely	70	20	25	25
		occasionally	94	35	30	28
		often	78	30	23	23
		always	9	0	4	5
Looking at allergy information	p = .48, *ns*	never	108	33	37	37
		rarely	92	32	29	30
		occasionally	57	22	15	19
		often	27	7	14	5
		always	19	6	5	9
Consumption yogurt	p = .023	weekly	211	74	70	64
		monthly	37	7	11	19

Variable	χ^2	Level	n	% condition 1	% condition 2	% condition 3
		5-11 times a year	25	9	9	6
		1-4 times a year	12	2	2	9
		never	18	7	8	2
Consumption pasta	p = .34, *ns*	weekly	239	80	79	79
		monthly	46	11	15	15
		5-11 times a year	6	3	2	2
		1-4 times a year	5	4	1	2
		never	7	3	3	2
Consumption lactose-free products	p = .39, *ns*	weekly	23	11	7	8
		monthly	21	6	5	7
		5-11 times a year	22	8	7	7
		1-4 times a year	44	17	17	15
		never	193	58	64	64
Consumption gluten-free products	p = .96, *ns*	weekly	14	6	5	3
		monthly	15	6	4	5
		5-11 times a year	20	6	6	9
		1-4 times a year	54	19	19	15
		never	200	64	66	68
Feelings about lactose	p = .58, *ns*	0 = extremely negative	6	2	1	3
		1	4	1	3	0
		2	14	5	5	4
		3	29	11	10	7
		4	42	13	13	16
		5	127	34	45	48
		6	26	10	7	9
		7	35	15	11	9
		8	14	7	4	2
		9	2	2	0	0
		10 = extremely positive	4	1	1	2
Feelings about gluten	p = .12, *ns*	0 = extremely negative	5	2	1	2
		1	2	0	2	0
		2	11	3	4	4
		3	29	9	7	13
		4	40	14	16	10
		5	124	34	40	50
		6	26	11	7	7
		7	37	13	14	10
		8	15	8	5	1

Variable	χ^2	Level	n	% condition 1	% condition 2	% condition 3
		9	7	6	1	0
		10 = extremely positive	7	1	3	3

Appendix 2

Table 12: Frequencies of definitions given to the lactose-free claim.

Definition	Symbol	Text	Symbol + text
	f	*f*	*f*
Lactosevrij	29	46	68
Bevat geen melk	23	9	4
Bevat geen zuivel	19	3	1
Geen melkproducten	6	10	2
Geen idee	11	4	0
Veilig te consumeren door mensen met een lactose intolerantie	0	5	3
Vrij van melksuikers	0	6	1
Bevat geen koemelk	2	3	2
Deze melk is lactosevrij	0	0	4
Lactose	3	0	0
Geen melkeiwitten	1	2	0
Geen lactose toegevoegd	0	1	2
Niet schudden	2	0	0
Bevat weinig lactose	0	2	0
Dat er weinig lactose in zit (onder een afgesproken grens)	0	2	0
Aangebroken verpakking niet bewaren	1	0	0
Bevat melk	1	0	0
Breekbaar	1	0	0
Geen zuivel producten eten	1	0	0
Halfvol	1	0	0
Koemelkallergie	1	0	0
Melkallergie	1	0	0
Melkfles..gaat over melk	1	0	0
Melkintolerantie	1	0	0
Niet drinken	1	0	0
Niet geschikt voor mensen die lactose intolerant zijn	1	0	0
Niet lactosevrij	1	0	0
Verboden flesgebruik	1	0	0
Geen producten afkomstig van koe	0	1	0

Definition	Symbol	Text	Symbol + text
Geen suikers	0	1	0
Goed voor darmen	0	1	0
Ik denk dat de fabrikant een claim op de verpakking van een product aanbrengt om zich te vrijwaren wanneer een consument aangeeft een reactie te hebben gekregen na het nuttigen van het product.	0	1	0
Vrij van melk en zuivel	0	1	0
Zonder melkstoffen	0	1	0
Zonder zuivel van koe gemaakt	0	1	0
Geen bestanddelen van melk	0	0	1
Geen koemelk lactose	0	0	1
Dat hier geen lactose in verwerkt is	0	0	1
Dit artikel is lactose-vrij, bevat 'dus' geen koemelk	0	0	1
Juiste omschrijving	0	0	1
Kan niet tegen zuivelproducten	0	0	1
Vloeistof zonder lactose	0	0	1

Table 13: Frequencies of definitions given to the gluten-free claim.

Definition	Symbol *f*	Text *f*	Symbol + text *f*
Glutenvrij	55	63	73
Bevat geen tarwe	14	1	0
Bevat geen graan	8	4	0
Bevat geen gluten of sporen daarvan	0	4	5
Geen idee	5	3	0
Gluten	6	0	0
Geproduceerd zonder gluten	0	4	1
Dat er weinig gluten in zitten (onder een afgesproken grens)	0	2	1
Niet plantaardig	2	0	0
Geen graanproducten in dit product	1	0	1
Veilig voor mensen met een gluten allergie	0	1	1
Geen gluten toegevoegd	0	1	1
Zonder tarweproducten	0	1	1
Zonder gluten en geschikt voor mensen met gluten intolerantie	0	1	1
Bevat geen plantaardige oliën	1	0	0
Bevat geen sporen van granen	1	0	0
Bevat geen tarwe/gluten	1	0	0
Bevat gluten	1	0	0
Geen bloem, glutenvrij	1	0	0
Geen bloemen plukken	1	0	0
Geen granen of glutenvrij	1	0	0
Geen granen of tarwe	1	0	0
Geen sporen van tarwe/graan	1	0	0
Geen tarwe gluten	1	0	0
Granen	1	0	0

Definition	Symbol	Text	Symbol + text
Kruiden	1	0	0
Niet biologisch	1	0	0
Niet geschikt voor mensen die niet tegen vezels/granen kunnen	1	0	0
Niet vegan	1	0	0
Niet vegetarisch	1	0	0
Plantaardig	1	0	0
Verboden gewassen	1	0	0
Bevat geen gluten (eiwit in zetmeel)	0	1	0
Dat er geen glutenbevattende (tarwe)producten inzitten	0	1	0
Dat gluten niet in de gevangenis zitten	0	1	0
Geen gluten, jippie dit kan ik eten. Dit product is vrij van glutenbevattende granen, het valt onder de norm "glutenvrij", bepaald promillage waarbij geen gevolgen ernstig zijn.	0	1	0
Geen glutenbevattende ingrediënten	0	1	0
Geen granen met gluten gebruikt	0	1	0
Gluten zitten in bepaalde graansoorten. Sommige mensen zijn er allergisch voor.	0	1	0
Iets met brood	0	1	0
Producten zonder tarwe, rogge, etc (meelproducten)	0	1	0
Voor mensen met gluten allergie voornamelijk broden	0	1	0
Vrij van bepaalde eiwitten die in brood zitten	0	1	0
Vrij van toegevoegde suikers in koolhydraten producten	0	1	0
Zonder een bepaald eiwit dat voorkomt in bepaalde granen	0	1	0
Zonder tarwemeel	0	1	0
Bevat geen eiwit afkomstig uit tarwen	0	0	1
Bevat geen glutenhoudende granen	0	0	1
Geen bestanddelen van granen	0	0	1
Er zit geen gluten, tarwe of gerst in het product	0	0	1
Graansoortvrij	0	0	1
Kan niet tegen gluten	0	0	1
Product zonder glucose	0	0	1
Vindt het symbool niet overeenkomen met het plaatje	0	0	1
Zie tekst	0	0	1

Appendix 3

Table 14: Frequencies of food allergies and intolerances participants have.

Food allergy or intolerance	Condition 1 *f*	Condition 2 *f*	Condition 3 *f*
Lactose	5	5	4
Noten	2	1	1
Gluten	2	1	0
Garnalen	1	1	0
Gluten en lactose	1	1	0
Kiwi	1	0	1
Alles	1	0	0
Geitenmelk	1	0	0
Kippeneiwit	1	0	0
Koemelkeiwit	1	0	0
Koolhydraten i.v.m. diabetes	1	0	0
Kreeft	1	0	0
Noten, appel, peer	1	0	0
Pinda	1	0	0
Schelpdieren en sommige noten	1	0	0
Zuivel	1	0	0
Aardbeien	0	1	0
Insuline	0	1	0
Pinda, noten, rauw eiwit	0	1	0
Caramel, kaneel, vanille	0	1	0
Framboos, avocado	0	1	0
Gluten, lactose, palmolie, aardbei	0	1	0
Hazelnoot, walnoot, appel, kers, perzik, necatrine, peer	0	1	0
Noten, melk	0	1	0
Noten, appel	0	1	0
Paprika	0	1	0
Pinda, soja, rogge en gerst	0	1	0
Rauwe appel, kers	0	0	1
Fruit	0	0	1
Melk, gluten	0	0	1
Noten, appels, perzik	0	0	1
Sesamzaad, schelpdieren	0	0	1

Table 15: Frequencies of food allergies and intolerances of the participants' good friends or family members.

Food allergy or intolerance of family member or good friend	Condition 1 *f*	Condition 2 *f*	Condition 3 *f*
Bepaalde soorten fruit	1	0	0
Gluten	6	5	8
Fructose, schaaldieren	1	0	0
Gluten, lactose	1	0	1
Lactose	2	8	9
Lactose, gist, eieren, druiven, paddenstoelen	1	0	0
Mango, kiwi	1	0	0
Melkproducten	1	0	0
Noten, pinda's	1	0	0
Noten, sesamzaad	1	0	0
Noten, lactose, bepaald fruitsoort	1	0	0
Alles	1	0	0
Schaal- en schelpdier	1	0	0
Soja	1	0	0
Zuivel	1	0	0
Zuivelprodukten, sommige fruitsoorten	1	0	0
Melk, noten, eieren, aantal fruitsoorten	0	1	0
Amandelen	0	1	0
Bovenstaande	0	1	0
Huisstofmijt	0	1	0
Ananas	0	1	0
Noten	0	2	1
Gluten, noten	0	0	1
Kippenei	0	0	1
Kiwi	0	0	1
Vegetarisch	0	0	1
Pinda, noten, vers fruit	0	0	1
Voedselpollen	0	0	1