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Allegory of Gluttony and Lust: Labelling of Food Allergens in Dutch Supermarkets

Floranne Boulogne, Kim Smulders, Jesse Buijink, Charlotte Kik, Angela Markovska, Frans J. van Overveld, Ioanna Paspali, Ana Županič and Ger T. Rijkers*

Science department, University College Roosevelt, Middelburg, The Netherlands

*Address for Correspondence: GT Rijkers, Department of Sciences, University College Roosevelt, P.O. Box 94, 4330 AB Middelburg, The Netherlands, Tel: +31-(0)-118 655 500; Fax: +31-(0)-118 655 508; E-mail: g.rijkers@ucr.nl

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ABSTRACT

The labelling of prepacked food products with information on 13 allergens on the mandatory European list (gluten containing cereals, crustaceans, eggs, fish, peanuts, soybean, cow's milk, nuts, celery, mustard, sesame seeds, lupine, and mollusks) was investigated in the major supermarket chains in The Netherlands. The label information of products from the leading a brand was compared with that of store brands. In general, store brands provide significantly better information about the presence or absence of specific allergens than the A brands do. This information however is restricted to the allergens on the mandatory European list, because the European labelling policies are based on averages for allergy occurrences in Europe. As such, kiwi fruit, a major top-10 occurring allergen in The Netherlands, is not indicated as mandatory. Therefore the labels may not always reflect the local needs of allergic patients. We may conclude that information for allergic consumers therefore can be improved.

Keywords: Allergens; Food products; Labelling; Leading brands; Netherlands; Regulation; Store brands

INTRODUCTION

Gluttony is one of the 7 deadly sins, as depicted in the painting Allegory of Gluttony and Lust (1490-1500) by Jheronimus Bosch (Figure 1). A deadly sin is a sin that, once committed, will lead you to hell after you die. For patients suffering from a food allergy (allos ergon), even a small amount of forbidden food could become a deadly sin because of an overwhelming response of the immune system. A food allergy is the result of an abnormal response of the immune system. During human evolution, a sophisticated immune system has developed to allow defense against pathogens and at the same time avoid the immune responses against both constituents from the own body or harmless substances from the environment, including food. However, when the immune system overreacts to stimuli from the environment, and specific target tissues (skin, airways, gastrointestinal) are hypersensitive to this response, then an allergic reaction takes place. Food allergy thus is characterized by an abnormal immune response to a specific food component.

An average human diet is composed of approximately 3,000 different proteins (and other nutrients for that matter). Up to now, over 125 food allergens have been identified, all of them was being small to medium-sized proteins belonging to 20 different protein families [1]. Food allergens can be animal (non-pollen related) or non-animal (either pollen- or non-pollen related) products. Re-exposure to the same food can trigger an immediate allergic reaction. The protein that acts as a food allergen is sometimes also expressed in several different plants which can lead to cross-reactivity. Thus multiple food allergens might bind to the same IgE-molecule. For instance, in case of kiwi fruit there is cross reactivity with banana, avocado, latex and the plant *Ficus benjamina*. Contact with these products might lead to sensitization to kiwis. As a result one could develop an allergic reaction to a kiwi without ever having been deliberately exposed.

Figure 1: A meat pie as depicted on the Allergy of Gluttony and Lust painting of Jheronimus Bosch (Yale University Art Gallery). The recipe of meat pie includes vegetable oil, minced beef, onion, tomato puree, flour, mushrooms, pastry, and egg. (Allergens requiring mandatory labelling are indicated in red). http://artgallery.yale.edu

The general advice in case of food allergy is complete avoidance of the allergen in question by dietary restriction. European regulation on product labelling is designed to facilitate these dietary restrictions. Considering the potentially life threatening response against a food component to which an individual is allergic to, it is extremely important that the food allergens are properly and sufficiently described on the food labels. The European Commission has released a list of 13 most common allergens whose presence in a specific food must be indicated on the label [2]. Among these most common allergens are cereals containing gluten, crustaceans, eggs, fish, peanuts, soybeans, milk, nuts, celery, mustard, sesame seeds, lupine, and mollusks. Sulphur dioxide and sulphites at concentrations of more than 10 mg / kg are added to this list, not because they are allergens but because these substances can lead to intolerance reactions. Although the European list of allergens is not exhaustive (see also below), it is more extensive than for most other countries [3,4], such as the USA with 8 allergens [5] and Australia with 10 allergens [6]. Japan has 5 mandatory allergens but an additional 18 recommended allergens [7].

Leading food brands in their advertising, label information and product display appeal to gluttony and lust of the consumer, but also emphasize the health effect of their products. It therefore could be hypothesized that the leading brands would also clearly state potential negative health effects. Therefore, the purpose of our study was to investigate whether leading food brands provide more detailed allergy information than corresponding store brands.

One could question whether a generalized European list of allergens is appropriate. While there is considerable overlap, some allergens from the Dutch top 10 food allergens (such as kiwi) are not included in the European list [8]. This may cause an unfortunate confusion in an individual who is allergic to kiwi owing to the insufficient information provided on the label.

We therefore also have investigated if and how the labels of the relevant food products contain information on the presence of non-mandatory allergens with a high prevalence, which in The Netherlands is kiwi. Precautionary allergen labelling ("Manufactured in a facility that also processes....") was left out of our analysis. We have performed the study in the major supermarkets of the Netherlands, two national chains, Albert Heijn (market share 35% in 2016) and Jumbo (18.4%) and two international chains, Lidl (10.3%) and Aldi (7.0%) [9].

METHODS

Procedure

The current study examined the presence of appropriate allergen labelling on the labels of food products in 4 big supermarkets in the Netherlands, 2 of which were Dutch, the 2 other ones are part of large chains operating in many European countries. The supermarkets included in the study were Albert Heijn, Jumbo, Lidl and Aldi. The supermarket chains were visited for the purpose of this study by Dutch high school students that gathered the data, after requested permission. Attention was given to the presence of the appropriate allergen labelling on the product, the font and type in which the allergen was indicated (bold/ capitals) to distinguish the allergens from the other ingredients, and/or additional highlighting of allergen information.

Label information on the 13 allergens of the European list in 3 categories of food, a) soft drinks, b) sweets, candy, cookies, and c) dairy products, was analyzed. To that end, in every supermarket, the allergen information given on the leading brand (the so-called A brand) for a given food product was compared back to back with the identical product of the store brand.

Data Collection

For the purpose of the study, a group of 30 high school students (13-15 years old) from the Pontes schools in Goes in the Netherlands visited the selected supermarkets and collected the data by making photographs of the relevant information on the label. The data collection also included thoroughly examining the allergen labelling on leading brand name products and store brand products in all 4 supermarkets. All the data obtained were checked, verified and complemented by the authors. They collected also specified information about allergens in products based on the Dutch top 10 list and labelling.

Allergen information on the (back of pack) label was categorized as follows: no information if either the ingredients of the product were not indicated or allergens were not marked. When allergens in the list of ingredients were indicated in a bold font or in capitals, this was scored as such. Allergens can also be indicated in a separate textbox labelled as "allergy information" or similar wording. The absence of specific allergens (i.e. gluten and cow's milk) with relevant pictograms was recorded separately. Any combination of above categories was found on individual food products, the most extensive information being bold font for allergens in the list of ingredients plus a separate allergy information box plus pictograms for absent allergens.

Statistical Analysis

Label information was statistically evaluated using Chi-square test. All tests were considered statistically significant at $P<0.05$.

RESULTS

Table 1 summarizes the main findings and provides additional information about the distribution over the three categories of food products. The allergen information on store brands from Albert Heijn, ALDI and Lidl was significantly better than the leading A brands (Chi-square: $P < 0.01$, $P < 0.05$, and $P < 0.01$, respectively). For store brands of the Jumbo supermarkets there was a trend for better allergen information than leading A brands ($P = 0.055$, Chi square).

Considering the food categories, we observed that all dairy products of Albert Heijn and Lidl had allergen information ($P < 0.01$, Chi square), and although the majority of dairy store brands in Jumbo and Aldi had this information, they did not significantly differ from the leading brands, of which the majority did not have this information.

Only in Albert Heijn and Lidl a significant difference ($P < 0.05$, Chi square) was observed for respectively soft drinks and sweets, when compared with the leading brands.

A further difference was found in the level of detail of the allergy information. On the labels of store brands of the national supermarket chains, the allergy information in most cases was provided both in the list of ingredients (in bold or capital font) as well as in a separate allergy information text box. In the international supermarket chains, the store brand food products had allergen labelling most often indicated by bold/ capital in the ingredient list. This difference in detailing of allergen information on store brands of national vs international supermarkets was highly significant ($p = 0.0003$, Chi square).

Next to analysis of the 13 mandatory allergens, we have also analyzed the information of a major allergen, not included in the list of 13: kiwi. The labelling of kiwi-containing products was examined in 2 representative supermarkets. These products primarily include fruit juices, smoothies and other similar drinks, fruit packages or fruit salads and baby food. No differences were found in the labelling between stores, or between the leading brands and store brands. In all of these products, kiwi was always indicated on the front of the package – in words or as a drawing/ picture – as well as on the ingredients list. However, it is nowhere indicated as an allergen, nor it

Table 1: Allergen labelling on food products, including the three categories mentioned in the text, from store brands as compared to leading brands in The Netherlands.

Allergen label	Store-brands from supermarket chains																			
	Albert Heijn				Jumbo				Aldi				Lidl				Leading brands			
	Soft	Sweet	Dairy	**Total**	Soft	Sweet	Dairy	**Total**	Soft	Sweet	Dairy	**Total**	Soft	Sweet	Dairy	**Total**	Soft	Sweet	Dairy	**Total**
None	2*	1	0**	**3****	5	1	1	**7**	5	0	1	**6***	4	0*	0**	**4****	5	4	4	**13**
Bold/CAPITALS	0	1	0	**1**⁺⁺**	0	0	0	**0**⁺⁺**	0	2	3	**5**	1	4	2	**7**	0	1	1	**2**
Allergen box	0	0	0	**0**	0	0	1	**1**	0	0	0	**0**	0	0	1	**1**	0	0	0	**0**
Pictogram	0	1	0	**1**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
Combined info	3	2	5	**10**	0	2	3	**5**	0	1	1	**2**	0	0	2	**2**	0	0	0	**0**
Total	5	5	5	**15**	5	3	5	**13**	5	3	5	**13**	5	4	5	**14**	5	5	5	**15**

Combined info means that the presence (or absence) of a given allergen is indicated in Bold or CAPITAL, and in an allergen box and/or in a pictogram.
Chi-square: *$P < 0.05$, **$P < 0.01$ as compared to the Leading brands.
Chi-square: ⁺⁺$P < 0.001$ as compared to the international chains Aldi and Lidl.

is written in bold or capitals. When the food product in question also included a mandatory allergen, those were indicated, but not the kiwi itself (see Figure 2 for examples).

DISCUSSION

Food allergy is common in the industrialized world. However, how common is difficult to assess. Self-reported adverse reactions to food tend to grossly overestimate the incidence of food allergy. In the context of the Europrevall project, a study was conducted in the Netherlands on the prevalence of food allergy in the general population [10]. To that end, in stage 1 of the study, a questionnaire was send out to 6600 random selected adults, of which 25% reported to have experienced an adverse reaction to any food. A smaller number, 10.8% reported adverse reactions to at least one out of 24 preselected priority foods (hen's egg, cow's milk, peanut, soy, hazelnut, walnut, celery, kiwi, apple, peach, sesame, mustard, wheat, fish and shrimp, buckwheat, corn, carrot, tomato, melon, banana, lentils, sunflower, and poppy seeds; underlined foods are on the European Union allergen list). In stage 2, participants were asked to come to the hospital for additional investigations. Of those willing to participate in stage 2, 38% positivity for serum IgE was found. The top 5 most prevalent allergens in stage 1 were cow's milk, apple, fish, kiwi and shrimp. In stage 2 is it was apple, kiwi, walnut, hazelnut and peanut [10]. In order to confirm the relative importance of kiwi as food allergen in The Netherlands, we checked with the major supplier of allergy diagnostic test kits for general practitioners. In the top-10 of food allergen testing, kiwi is at position 10 and cashew at position 8. All other food allergens in the top 10 are included in the European list of 13.

In case of food allergy, avoidance of exposure to allergens is the hallmark of preventive therapy. For airborne allergens such as pollen, avoidance in general is possible but sometimes difficult to achieve.

Figure 2: Absence of allergy information on kiwi containing food. Figure indicates in the left column from top to bottom examples of the front pack labelling of kiwi in a fruit salad, a dairy drink, and a smoothie. The right column indicates that the presence and concentration of kiwi is indicated in the back pack labelling, but no information is provided that kiwi is a potential allergen. Other allergen information is given in bold; absence of gluten and milk is provided by pictograms.

In case of food allergy, the non-processed product in question can relatively easily be avoided. For processed foods, whether or not prepacked, food allergic patients have to rely on proper labelling of food products. This is why member states of the European Union have mandatory labelling for the 13 most common allergens and sulphur oxide [2]. A remarkable finding in our study is the differential labelling stringency between the leading brands and the store brands. Our study did not address the question of why leading brands have less information about allergens on their label. We can only speculate about the reasons why to minimize the information on allergens. Leading brands in their marketing focus on the quality, nutritional value, and, if allowed, beneficial health effects of their product. Overall they create an image of health and happiness associated with use of their products and try to stay away from diseases and health-risks. Any association with allergy, including extensive attention for potential allergens, in such a marketing concept would be avoided. At this point it cannot be determined whether these, or totally different arguments have played a role in differential labelling stringency.

Our study was conducted in The Netherlands, a European Union member state and therefore complying with European allergen labelling legislature. The analysis did include ALDI and Lidl stores, both European supermarket chains, with stores in 13 and 27 (both Western and Central European countries, respectively. In order to find out whether in other European countries, the national supermarket chains would also have a differential labelling strategy between leading brands and store brands, the major national supermarket chains in Belgium and France were also checked. In France, Carrefour (21% market share), Intermarche (14%) and Super U (10%) were investigated, in Belgium Colruyt (25%), Delhaize (22%) and Carrefour (22%). In French and Belgium supermarkets, not all the 15 items which were investigated in Dutch supermarkets were available. While this makes direct comparison difficult, a similar trend as observed in the Netherlands was also found in France and in Belgium: store brands have a more elaborate and clearer labelling of allergens than the leading brands. More elaborate research, including Central European countries, would be needed to draw more general conclusions.

Consistency in food allergen labelling is important. The absence of information about a given allergen can (and should) be interpreted by the consumer as the absence of that particular allergen in the product. The pictograms for gluten-free and milk-free therefore could give a mixed message to patients with allergies to other food components, such as egg for instance. On the one hand it could give a false sense of safety ("allergen-free") and, on the other hand, it could also give a warning signal ("my" allergen is not indicated). Inconsistent labelling therefore could be misleading.

A similar false security may be presented to patients with nut allergies because of differences in information on the label about the production processes. Some packages feature a passage stating the product was made or prepared in a factory where also nuts were handled. However, whether products that do not include this warning can be trusted to be nut-free is unclear. This poses serious consequences for the consumer. There is inconsistency in this form of precautionary allergen labelling [11], and also the understanding by consumers of the message is poor [12]. Peanut allergy prevention and treatment has seen a paradigm shift: early exposure to low quantities of peanut containing food, rather than complete avoidance, may reduce the severity of allergic reactions later in life [13]. Whether, this also holds true for other food allergens remains to be established.

Until then it remains of vital importance that food is properly labelled in order to allow allergic patients to select safe food.

Current European labelling policies are based on European averages for allergy occurrences. However, national food allergy frequencies can differ from the European average. Therefore the labels on products may not reflect the local needs of patients seeking to avoid allergens. We found that kiwi, a fruit widely used in many drinks and smoothies, in mixed salads, and in baby food, never is indicated as a potential allergen. On the one hand, this is understandable because kiwi is not on the European list of 13 mandatory allergens. On the other hand, in The Netherlands kiwi is one of the top 5 allergens. Fortunately, of all food products investigated, the presence of kiwi was clearly indicated on the front of the pack. Formally, when the name of the food clearly refers to the substance or the product (such as milk or kiwi), European regulation does not require mandatory allergen labelling (reference) [2]. However, the absence of kiwi on the list of ingredients does not mean that the product would not contain any kiwi. A recent Italian study shows that even for cow's milk and eggs, up to 2.8% of the products analyzed did contain these allergens without any indication on the label [14].

The consumer must not be assumed to be well informed. Less knowledgeable patients should also be able to select safe food. To protect these patients as well, the ingredients should not only be typed as being a potential allergen, but also according to which of the common allergen groups it belongs to. A sushi dish containing tuna would then be labelled as containing fish. It is debatable whether negative allergen information (such as the indication that a given product is gluten-free) would be always necessary or even advisable. For bakery products, a gluten-free label is essential, for mineral water such a label would be redundant. For those products with an incomplete ingredient list it could be useful, but allergen declaration would still be required [2]. Since the recipe of cola is being kept secret, possibly essential information is missing on the ingredient list. It is remarkable that the two leading brands of cola do not feature any additional allergy information on their labels, while some store brands do.

A limitation of our study was that the analysis of allergen labelling was restricted to 3 categories of food: sweets, soft drinks and dairy products. Selection was left primarily to the high school students who made the initial visits to the supermarkets (but all data were checked and verified by the research team). It therefore may reflect the range of products chosen by the younger shoppers who visit supermarkets without parental guidance. For that category, clear-cut allergen labelling could be even more important. While for these reasons, the range of food products was limited, we have no a priori reason to expect different labelling policy for other food categories. The selection was also restricted in the sense that only products for which a leading brand and corresponding store brand was available.

The advice of the Dutch Health Council in 2007 on food allergies included to improve the provision of information to patients. The committee recommended to consider periodically which allergens need to be included in the national allergen databank. Furthermore, it was concluded that patients with a food allergy would benefit from an automated system such as a Smartphone app that can be used when shopping. During our study we tested several currently available apps (including Fooddler (http://www.123feelfree.be) and Allergie Analyse (in Dutch, other languages supported, http://www.riom.nl/Allan.aspx)) but neither of them gave completely accurate information about allergens. The advantage of such an app is evident because it can be personalized for relevant allergens and would not have to be restricted to the formally required allergens. The downside is that by scanning a barcode, the information obtained is totally dependent on what is provided by the producer. It would therefore require a joint and lasting commitment of all stakeholders to develop such a consumer tool.

At the time Jheronimus Bosch painted Allegory of Gluttony and Lust, prepacked food did not exist yet. Food allergies may have been more uncommon, although we do not know that for sure. At any rate, when a complete meal is made from scratch, there are no hidden ingredients, so unintentional exposure would be avoided. Nowadays, consumers who buy a meat pie, a fruit salad, a soft drink or whatever, has only the information on the label to decide whether or not that particular product could pose a health risk. Our data show that over a wide range of prepacked food categories, the store brands are labelled adequately, in many cases even better and more complete than the leading brands.

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