Expect the unexpected
Food trends influencing food allergy trends?

Stefan Schmidt • FAMS 2023 • Brisbane

Food trends cause changes in consumption – maybe changes in allergen exposure as well?

Looking at some of the major food trends of the last years:

- Sustainability
  - » Innocent consumption - “Good for me & good for our planet”
  - » Upcycling – Food waste reduction “Nose-to-tail & Root-to-stem”
- Plant based everything
- BioTech Foods / Fermentation
- Clean label / “Free From”
- Gut Health: Probiotics & Prebiotics
- Regional, DIY, authentic and ethnic flavors

Do these trends have an effect on our exposure to food allergens and its analysis?

Two different situations regarding allergen exposure

- Unintended presence of allergens (contamination) in food are an imminent risk for sensitive persons
- Intended presence may impact food allergy prevalence

First: Are allergens „food contaminants“?

According to EU regulation a “food contaminant” is any harmful substance not intentionally added to food.

They may be of natural origin or as a result of production, processing, transport or environmental contamination.

Examples are:

- Antibiotics and other veterinary drug residues
- Heavy metals
- Pesticides
- Microorganisms (e.g. Salmonella, Listeria, Norovirus)
- Natural toxins (e.g. mycotoxins)

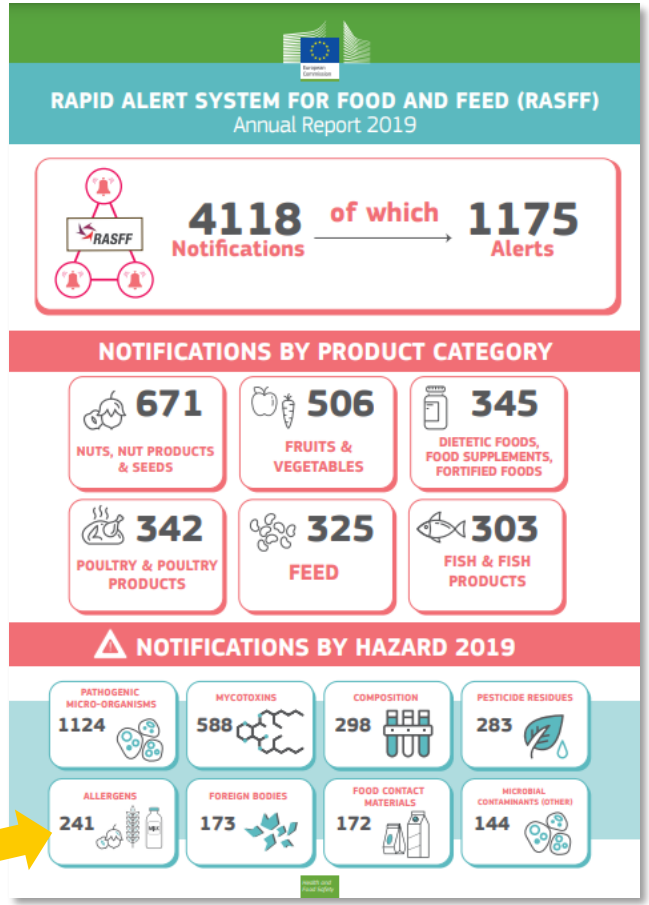
Food allergens are not considered to be “food contaminants”… (but…)

The EU Rapid Alert Systems is a good monitor

RASFF (2019 data):

4118 Notifications,
1124 for pathogens,
588 for mycotoxins,
283 ~~pesticides~~,
241 for allergens

Source:
https://ec.europa.eu/food/safety/rasff-food-and-feed-safety-alerts/rasff-consumers-portal_en



Plant based „everything“

One the biggest food trends is plant based „everything“

- Global data say that currently 5 % of the population is vegan, 11 % vegetarian and 20 % “flexitarian”
- The European plant-based market grew by 49 %, from € 2.4 billion from 2018 to € 3.6 billion in October 2020
- The US plant based market grew by 43 % to $ 7 billion from 2018 to 2020.

Plant based „everything“

Main market drivers (consumer drivers):

- Personal health (“Better for you”)
- Sustainability – „Better for the planet“

Main arguments are: Reducing water use, protecting eco-systems, reducing waste, reducing carbon emissions

Plant based „everything“

One the biggest food trends is plant based „everything“

- In most countries the market is led by plant-based “milk”, followed by plant-based “meat”, but plant based ice cream, “cheese”, “yoghurt”, “eggs” are following.
- In US, plant based “milk” has a 15 % share of total milk sales, yet plant based “meat” app. 1.4% of total meat sold in retail

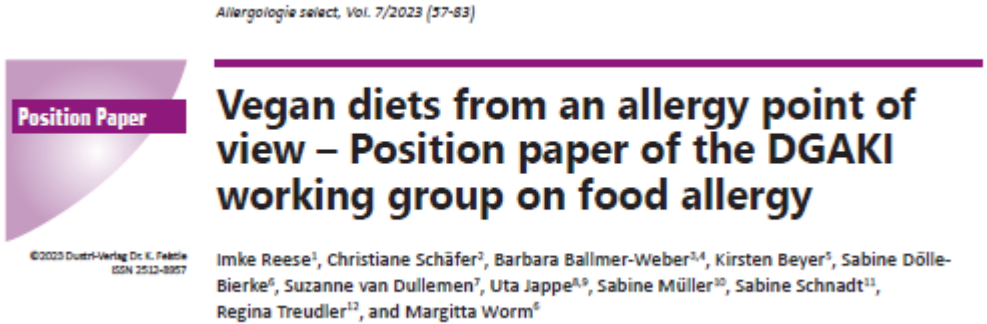
Plant based milk alternatives

Most popular plant based milk alternatives are based on almonds (in US app. 2/3), oats (most popular source in EU) and soy but also rice, coconut, hemp….

Production process is basically making a water based suspension of the main ingredient (between 2% (almond), 10% (soy) or up to 12% (oats) by soaking, wet milling and separation of the solids by filtering / decanting followed by adding stabilizing ingredients and pasteurization.

Question is: Will the change from milk to milk alternatives impact the prevalence of allergies?

Effects of food trends on allergy prevalence – changes in total allergen exposure?



Allergologie select, Vol. 7/2023 (57-83)

Position Paper

Vegan diets from an allergy point of view – Position paper of the DGAKI working group on food allergy

ISSN 2512-8957

Imke Reese[1], Christiane Schäfer[2], Barbara Ballmer-Weber[3,4], Kirsten Beyer[5], Sabine Dölle-Bierke[6], Suzanne van Dullemen[7], Uta Jappe[8,9], Sabine Müller[10], Sabine Schnadt[11], Regina Treudler[12], and Margitta Worm[6]

- … (so-called) milk alternatives are evaluated from an allergy and nutritional point of view.
- … as significant protein sources in vegan diets (e.g., legumes, nuts, and seeds) are at the same time potential and potent triggers of allergic reactions.

Reese I, Schäfer C, Ballmer-Weber B, Beyer K, Dölle-Bierke S, van Dullemen S, Jappe U, Müller S, Schnadt S, Treudler R, Worm M. Vegan diets from an allergy point of view – Position paper of the DGAKI working group on food allergy. Allergol Select. 2023; 7: 57-83. DOI 10.5414/ALX02400E

citation

New“ ingredients and raw materials may also introduce „new“ potential allergens

Received: 25 April 2022 | Revised: 14 October 2022 | Accepted: 6 November 2022
DOI: 10.1111/pai.13889

ORIGINAL ARTICLE

WILEY

Allergenic risk assessment of cowpea and its cross-reactivity with pea and peanut

Mouhamed Mounir Chentouh[1,2] | Françoise Codreanu-Morel[3] | Aissa Boutebba[1] | Stephanie Kler[2] | Dominique Revets[2] | Annette Kuehn[2] | Markus Ollert[2,4] | Christiane Hilger[2]

- Cowpea, a member of the legume family, showed skin test reactivity, IgE-binding and basophil activation in patients with legume allergy
- Legume seeds and their derived products are increasingly used in food industry due to their nutritional composition and technological properties.
- … important source of low cost proteins … for the formulation of processed food.
- Allergen labeling regulations require the declaration of peanut and soybean as allergens in food products. Other legumes, except lupine in Europe and Australia, are exempt of allergen labeling policies.

Plant based meat alternatives - some examples of ingredient lists

- The recipes / ingredient lists may be quite complex

“Chicken” patties:

Water, **wheat** flour, vegetable oil (corn, canola and/or sunflower), **soy** protein concentrate, **soy** protein isolate, contains 2% or less of yellow corn flour, **wheat** gluten, dextrose, methylcellulose, yeast extract, sugar potato starch, cornstarch, wheat starch, salt, spices, natural flavors, onion powder, paprika color, leavening (sodium acid pyrophosphate, sodium bicarbonate), potassium chloride, yeast, glutamic acid, garlic powder, citric acid, xanthan gum, **barley** malt extract

Veggie Burgers:

Water, carrots, onions, **soy** flour, **egg** whites, mushrooms, whole grain **oats, oats, wheat** gluten, water chestnuts, vegetable oil (corn, canola, and/or sunflower oil), green bell peppers, calcium caseinate (from **milk**), cooked brown rice (water, brown rice), red bell peppers. Contains 2% or less of onion powder, corn starch, **soy** sauce powder (**soy** sauce, soybeans, salt, **wheat**), sugar, black olives, salt, spices, garlic powder, jalapeno peppers, xanthan gum.

Upcycling

Upcycled foods use ingredients that are otherwise not used for human consumption, typically byproducts of food production but sometimes also food waste.

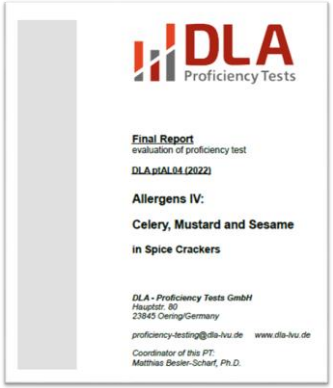
Actually – that is not so new…

- Famous example: Grappa (Fermentation and distillation of the wine pomace)
  Another older example of root-to-stem: Dolmas – stuffed grape leaves ☺
- Berry pomace is also a great source of functional ingredients (antioxidants)
- Another example: Brewers spent grain after beer brewing
  Used to be sold as animal feed but is also the basis of nutrient-rich puffed snacks, pasta….

Something to keep an eye on though:

Allergens in highly processed foods may alter their conformation and/or extractability and make correct analysis more difficult!

Impact of food processing on analysis


DLA
Proficiency Tests

Final Report
evaluation of proficiency test

DLA ptAL04 (2022)

Allergens IV:

Celery, Mustard and Sesame

in Spice Crackers

DLA - Proficiency Tests GmbH
Hauptstr. 80
23845 Oering/Germany

proficiency-testing@dla-lvu.de www.dla-lvu.de

Coordinator of this PT:
Matthias Besler-Scharf, Ph.D.

Ingredients	Sample A	Sample B	Spiking Level Sample
Sesame, white (Sesamum indicum)		-	
ground, mixture of 10 products (Africa, Asia, South America)			
– as Sesame seed*	18,2 mg/kg		12,7 mg/kg
– *thereof 24,5% total protein***	4,45 mg/kg		3,12 mg/kg

There are **two different samples A** and **B** possibly containing the **allergenic parameters** in the range of mg/kg in the specified **food matrix**. One of these samples and the additional **"spiking level sample"** were prepared by adding the allergenic ingredients. The "spiking level sample" contains the allergens in a **simple matrix** (potato powder) in similar amounts without further processing.

Afterwards, the **spiked sample A** was produced as follows:
As a further ingredient, spice crackers were baked with the spiking material (200°C, 30 min), which contains the allergenic ingredients celery, mustard and sesame, and then dried (40°C, overnight). After

Results

Sample A

Statistic Data	All Results° [mg/kg]	Method RS-F [mg/kg]
Assigned value (X_{pt})	$X_{pt_{ALL°}}$	$X_{pt_{METHOD\ RS\text{-}F}}$
Number of results	15	13
Number of outliers	-	0
Mean	9,53	21,7
Median	9,10	21,1
Robust Mean (X_{pt})	**9,41**	**21,8**
Robust standard deviation (S*)	**3,01**	**7,38**
Target range:		
Target standard deviation σ_{pt}	**2,35**	**5,45**
lower limit of target range	**4,71**	**10,9**
upper limit of target range	**14,1**	**32,7**
Quotient S/σ_{pt}*	*1,3*	*1,4*
Standard uncertainty $U_{(Xpt)}$	*0,972*	*2,56*
Results in the target range	*12*	*12*
Percent in the target range	*80*	*92*

Spiking Level Sample

Statistic Data	All Results° [mg/kg]	Method RS-F [mg/kg]
Assigned value (X_{pt})	$X_{pt_{ALL°}}$	$X_{pt_{METHOD\ RS\text{-}F}}$
Number of results	14	12
Number of outliers	-	0
Mean	20,0	32,6
Median	14,5	32,3
Robust Mean (X_{pt})	**15,0**	**32,8**
Robust standard deviation (S*)	**6,67**	**11,9**
Target range:		
Target standard deviation σ_{pt}	**3,76**	**8,19**
lower limit of target range	**7,51**	**16,4**
upper limit of target range	**22,5**	**49,2**
Quotient S/σ_{pt}*	*1,8*	*1,5*
Standard uncertainty $U_{(Xpt)}$	*2,23*	*4,30*
Results in the target range	*11*	*9*
Percent in the target range	*79*	*75*

Target values: 18.2 mg/kg 12.7 mg/kg

Recovery: 51.7 % 119.8 % 118.1 % 258.3 %

Case study from a routine lab

Problems when analysing (certain?) vegan “chicken” nuggets with RIDASCREEN® Gliadin

- Positive results appear, which cannot be confirmed with other methods
- Customer’s extracts and original sample tested at R-Biopharm negative

What happened?

- Laboratory increased extraction temperature by 10 °C to 60 °C and shortened the extraction time
- This was used with all samples without any problem
- However, a transient false-positive reactivity appeared with the vegan chicken nugget, which was not present some hours after the extraction

Expect the unexpected

Selection of extraction procedure for Gliadin analysis

1) 60 % Ethanol

for native samples,
less sufficient for
heat-processed

2) Cocktail (patented)

sufficient for native and
heat-processed samples
(official Codex and AOAC method)

3) Cocktail ECO

alternative to Cocktail (patented),
faster and easier to handle
(no Codex and AOAC method)

Publication of the Cocktail (patented) procedure

García E et al.: Development of a general procedure for complete extraction of gliadins for heat processed and unheated food. Eur J Gastroenterol Hepatol (2005), 17(5): 529-39

Scope reduction of AOAC OMA 2012.01 for Final Action led to irritations in the analytical community

RIDASCREEN® Gliadin R7001 (R-Biopharm AG)

- Codex Alimentarius Type I method
- AOAC PTM 120601
- AOAC OMA 2012.01 First Action (based on 1st collaborative study) with an **“in foods claim”**
- AACCI 2nd collaborative study, AACCI method 38.50.01
- ICC Standard Method No. 182 (2016)
- Since 2016, AOAC OMA Final Action with a “**rice- and corn-based matrices claim”** (formal decision as these were the matrices tested in the 1st collaborative study)
- Irritations in the analytical community as laboratories were unsure which matrices could be analyzed or would have to be additionally validated
- **3rd collaborative study in 2020 with a wide range of different matrices to demonstrate its wide applicability**

3rd collaborative study to show applicability for in food generally

Sample overview

Sample	Processing
Starches	Mixing / blending
Pseudo cereals	Mixing / blending
Legumes	Mixing / blending
Soy	Mixing / blending
Spices	Mixing / blending
Juice	Mixing / blending
Cream cheese	Mixing / blending

Sample	Processing	Time	Temperature
Nut nougat crème	Heating	60 min	80°C
Pesto	Heating	5 min + 10 min	100°C + 80°C
Candies	Cooking	15 min	100°C
Dessert	Cooking	10 min	100°C
Fish	Cooking	20 min	100°C
Potatoes (gnocchi)	Cooking	15 min	100°C
Potatoes (gnocchi)	Microwaving	2.5 min	1500 W
Meat	Frying	16 min	190°C
Vegetarian meat alternative	Frying	16 min	190°C
Cake	Baking	55 min	170°C
Cookies	Baking	25 min	150°C
Bread	Baking	60 min	180°C

New wording of AOAC OMA 2012.01

- Successful 3rd collaborative study with an unprecedented wide range of different food matrices
- Clear demonstration of the wide applicability of OMA 2012.01, new applicability statement

AOAC Official Method 2012.01
Gliadin as a Measure of Gluten in Food
by R5 sandwich ELISA RIDASCREEN® Gliadin […]
First Action 2012, Final Action 2016

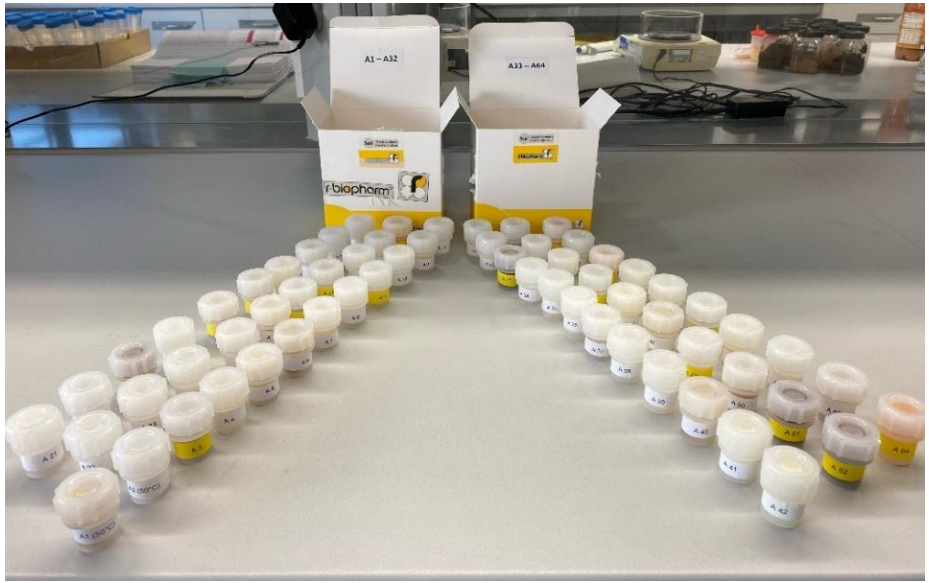
Applicable for the quantitative measurement of intact gliadin as a measure of gluten in unprocessed and processed matrices from important gluten-free food categories including rice- and corn-based products, soy, starches, pseudo cereals, legumes, spices, juice, nut nougat crème, cream cheese, pesto, meat, vegetarian meat alternative, cookies, dessert, cake, fish, bread, candies, and potatoes. […]

- Results have been published in the Journal of AOAC International

Collaborative study consisted of 64 blind coded samples analyzed by 14 laboratories, in total 896 samples

14 Laboratories

- Austria
- Canada (2)
- Finland
- Germany (4)
- Ireland
- Italy
- USA (4)



32 different samples with blind coded duplicates (1-64)

Usually, certain food matrices are validated

The situation we are faced to

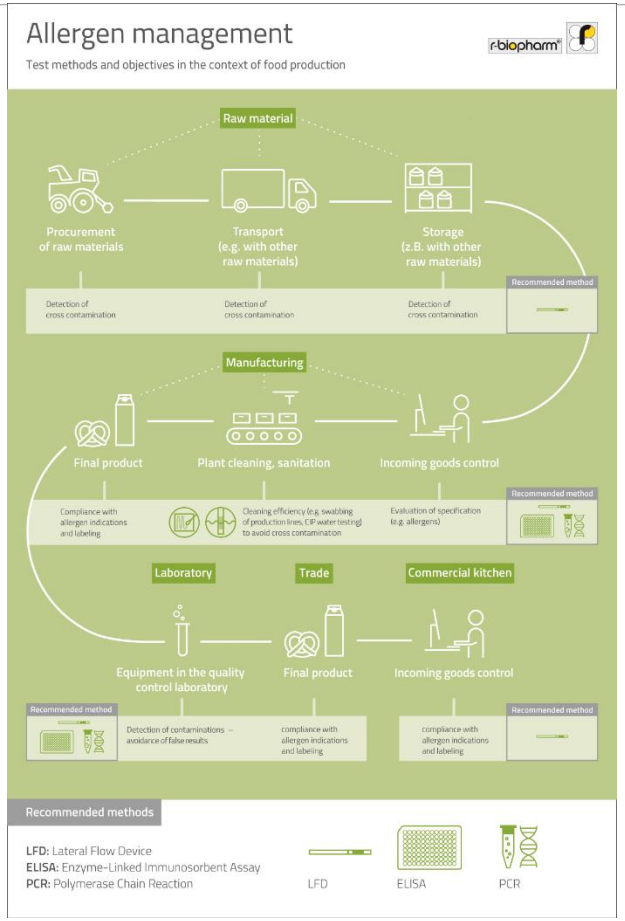
- Reams of foods are available that cannot be considered during assay development
- Typical foods are chosen for assay validation
- “New” ingredients are used for food production
- New recipes are developed daily by food industry
- New technologies are used
- The more complex a processed food is, the more difficult extraction may be

Hence, analytical labs need to validate their methods in use carefully for different foods. We as a kit manufacturer provide as much information as possible with our assay validation reports.

Allergen management

Allergen management with these recipes is…. challenging!

- Many ingredients to manage (allergen specifications, raw materials)
- Risk of hidden allergens
- Cross contaminations
- Cleaning procedures very important
- Analytical challenges in end-product testing



To summarize….

- The current food trends may have a major impact on our daily diet and therefore our total daily exposure to certain allergens
- Further research is needed to estimate the impact more correctly
- Good allergen management is needed
- Analytical methods need to be validated for the new / modified matrices
- Expect the unexpected




Thank your for your attention!

Interested to learn more?

https://food.r-biopharm.com/

https://linkedin.com/company/r-biopharm-ag

https://www.youtube.com/user/RBiopharmAG

https://twitter.com/rbiopharm