Allergen risk assessment for adventitious contamination of soya in wheat flour milled and consumed in the UK

1. Statement of Purpose

FSA needs to revisit its evidence base regarding adventitious contamination of soya in wheat flour and grist to inform its risk management position on this issue. This will help to inform both FSA's handling of incidents involving adventitious contamination of soya and the advice that FSA provides more widely to industry regarding reference doses and action levels for contamination of soya in wheat flour.

A risk assessment is required to understand the risk to the allergic population associated with soya in wheat flour milled and consumed in the UK. In particular, this needs to take into account up-to-date industry data on prevalence/levels of soya contamination, the potential impact of processing and heat treatment on allergenicity of soya and the applicability of current reference doses to adventitious soya in wheat flour.

2. Hazard Identification

Allergens in Soybean

Soybeans and products thereof are a recognised as a common cause of food allergies and thus are included on the EU1169/2011 annex II list of declarable allergens.

Soybean (soy seed) (Glycine max) is an edible legume belonging to the Fabaceae family. The seed contains 20% oil and approximately 35-40% proteins, of which at least 33-38 IgE- reactive proteins have been suggested as allergens. Among those, 8 allergens are officially registered on the World Health Organisation/International Union of Immunological Societies (WHO/IUIS) Allergen Nomenclature Subcommittee (Appendix table 1). The clinical relevance of different soya allergens can vary depending on the allergic individual but certain proteins such as Gly m 4, 5, 6 and 8 have been demonstrated as good markers for predicting clinical relevance (Kattan & Sampson. 2015). In addition, the papain protease protein, Gly m Bd 30k, is thought to be an immunodominant and clinically relevant allergen despite it being estimated to only make up 1% of total soybean seed protein (Wilson 2008; Jeong et al. 2013; Tsai et al. 2017).

3. Hazard Characterisation

Uses of Soybean

Consumption of soya is widespread in Asia and the USA and has increased in Europe in recent years. In vegetarian cuisine soy is consumed as soy oil, soya flour, soymilk, soy drinks, soya flakes or as fermented soybean products such as Miso, Okara, soy sauce (Tamari, Shoyu), tempeh or tofu.

Soya products are also used in the food industry for technological reasons as texturizers, emulsifiers and protein fillers; it is cheap protein source and may be part of a wide variety of processed foods such as meat products, sausages, bakery goods, chocolate or breakfast cereals.

Prevalence of soya allergy

Soya allergy is mainly reported in young children as compared with adults as it is reported that children often develop tolerance or 'grow-out' of soya allergy (Savage et al. 2010). The exact prevalence of soya allergy is unknown in the UK. The population based EuroPrevall birth cohort study has confirmed 0.4% as the prevalence rate for soya allergy in children up to the age of 2 years (Grimshaw et al. 2016). Previous studies also generally support this estimation (Kattan et al. 2011; Roehr et al. 2004; Young et al. 1994; Bock. 1987). Adult data on confirmed food allergy are too limited to estimate this prevalence rate.

Severity of reactions to soya

Soybean-induced allergic symptoms can range from skin, gastrointestinal, or respiratory tract reactions up to anaphylaxis leading to death although severe reactions appear to be rarer than for some other food allergies (Sicherer et al. 2000a; 2000b) and tend to be towards less processed forms of soya.

Reported symptoms in response to soya flour material are, oral allergy syndrome, angioedema, dyspnea, dysphagia, emesis, decrease in blood pressure, urticaria, nausea, gastrointestinal pain, dysphonia, tightness of throat or chest, blisters of the oral mucosa, pruritus, flush, conjunctivitis and laryngeal edema (Ballmer-Weber et al. 2007). Exercise-induces anaphylactic reaction to soya has also been reported (Adachi et al. 2009).

Due to similarities of structure of soybean allergens with other allergens, cross-reactive allergies are possible particularly in those with birch pollen, other legume and/or bovine casein allergies. A study (DeSwert et al. 2012) looking at secondary allergy to soybean (with cross-reactivity from a primary allergy to birch pollen) found that of the 15 participants with birch pollen allergy, eight were also allergic to soya. All eight had acute symptoms, and three of them showed chronic (long-term) symptoms.

Adventitious contamination of wheat flour with soybean

The adventitious contamination of wheat flour with soya is known to occur due to the manner by which soybean and other grains, such as wheat, are grown, harvested, stored and transported, leading to detectable level of soya in raw wheat flour. As part of long-standing agricultural practices, it's common for cereal grains, oil seeds and pulses to be grown near one another and are often harvested, handled, stored and transported using the same equipment and infrastructure making it difficult to eliminate low levels of cross-contamination via agricultural co-mingling.

With respect to only UK wheat, storage and transportation are identified as the contamination risk areas due to soya not being grown in the UK. The Codex

Committee of Food Hygiene have been developing a code of practise on food allergen management for food business operators, which at the November 2019 meeting was agreed to be sent to the final stage 8 (adoption and publication), lays out ways in which all allergens should be managed from farm to fork. Within this code of practice, and most relevant to this paper, it identifies the 4 stages mentioned above and identifies the following factors contributing to exposure:

- inadequate or ineffective cleaning of containers, including reusable bags, and transport vehicles;
- inadvertent inclusion of foreign particulates (e.g. grains, nuts or seeds);
- inadequate physical separation or storage of commodities with different allergen profiles; and
- inadequate or a lack of employee training and awareness on managing food allergens.

It should be noted that wheat flour is widely used in food products which already contain soya-based ingredients; in these cases, soya contamination is not an issue as allergic consumers would avoid such products. However, there are products which do not contain soya ingredients and consideration will need to be given to the level of risk associated with adventitious soya contamination in such cases.

Incidence of allergic reactions to soya and specifically associated with wheat products

The incidence of allergic reactions to soya associated specifically with soya contamination of wheat products have not been reported**. It should be noted that there is currently no systematic way of reporting allergic reactions to food so absence of evidence in this case cannot be assumed to indicate evidence of absence**. The FSA is currently in the process of developing a mechanism for reporting of reactions involving food allergens that will enable such data to be gathered in future.

Terms used in allergen risk assessment

When looking at hazard characterisation and risk levels for allergens in food, it is important to explain the meaning of different terms used in this context.

- Eliciting dose (ED): the dose (mg) predicted to provoke reactions in a defined proportion of the allergic population. E.g. ED_{01} equals the dose predicted to provoke a reaction in 1% of the at-risk allergic population. ED_{05} is the dose predicted to provoke a reaction in 5% of the at-risk allergic population. These are derived through using data from oral food challenges with allergic individuals
- Reference dose: an acceptably low eliciting dose level (mg) e.g. ED_{01}, ED_{05} chosen as a health-based intake limit
- Reference amount: the maximum amount of food eaten in a typical eating occasion
- Action level: The protein concentration (mg/kg) in food as consumed that can be present in a food without it being an issue for the majority of allergic

individuals concerned, as defined by the selected reference dose based on specified conditions of exposure (e.g. serving/portion size, consumption amounts, inclusion levels), above which action is warranted to address the risk to the allergic population

Application of levels

A risk assessment was conducted by the FSA in September 2014 utilising the conclusions from a 2013 published paper from Remington et al the Food Allergy Research & Resource Program (FARRP), which used a probabilistic approach. An action level was given of 236 mg/kg which was based on a 30g reference amount which equated to a dose of 7.1mg soya protein in a single eating portion. However, since then, there has been wide acceptance for the use of population eliciting doses (EDp), in deterministic risk assessment of allergens in final products (meaning those intended for presentation to the consumer).

The most widely accepted eliciting dose and reference values also come from FARRP (and others) and are adopted into the Voluntary Incidental Trace Allergen Labelling (VITAL) system created by the Allergen Bureau and are widely accepted as suitable reference dose levels amongst industry and regulators (Taylor et al. 2014; Remington et al. 2020). The previous ED for soya, published in 2014, was based on a 5% eliciting dose level (ED_{05}) at 1.0mg and was utilised by FSA for the risk assessment of levels in final products for food incidents. Sufficient data were not available at the time to derive a robust ED_{01}.

Updated eliciting dose levels for various allergens, in-line with those under the EU 1169/2011 annex II list of allergens, were then recently published in March 2020 (but released in VITAL 3.0 in September 2019) which gave an ED_{01} and ED_{05} (where only 1% and 5% of the soy allergic population would be predicted to experience any objective allergic reaction) for soy protein of 0.5mg and 10mg respectively. In the interest of proportionately protecting the allergic consumer, the FSA utilises ED_{01} levels (where available) as suitable reference doses where applicable for determining the risk posed by levels in a final product. This is also in-line with the approach recommended by the VITAL Scientific Expert Panel.

Although it is clear how to assess the risk of a final product, there are **uncertainties** around how industry should best apply the use of references doses at the raw/bulk ingredient/product level, and specifically soya in wheat. This is partly due to variation in the level of inclusion in final products, consumption amounts, and the potential effects of processing on the allergenicity and detectability of soya and therefore, the suitability of suggesting an indicative reference amount and action level for flour in general in place of tailored calculations for every product the ingredient/flour is used in.

Effect of processing on soya allergenic proteins

The risk assessments performed by industry when deciding on the use of an action level(s) should consider the final destination of the wheat flour and the extent and type of processing involved until the point of consumption by the final consumer. However, there are uncertainties around the effect of processing commonly applied to wheat flour-based products on the allergenicity and detectability of soya proteins. Most of the food products containing wheat flour are submitted to thermal treatments (baking, boiling, roasting, autoclaving, microwave heating, etc.) during their industrial production or cooking at home, therefore, if adventitious soya is present in the flour, it be subject to this processing also. Thermal treatment of food proteins is known to cause different modifications and conformational changes that may affect the epitope binding of allergens and therefore capacity to elicit an allergic reaction by either enhancement (exposing or creating new epitopes) or reduction (loss of epitope) (Verhoeckx et al. 2015).

Overall, there is evidence to suggest that processing (thermal and pressure) could have an effect on reducing the detectability and allergenicity of major soya allergens and thus could reduce the risk to the allergic population but the extent to which this may occur is subject to various factors, in particular temperature and duration, and there is no robust evidence to suggest the risk could be eliminated completely through processing alone. (Amigo-Benavent et al. 2008; Wilson et al. 2008; Gomaa & Boye. 2013; Verhoeckx et al. 2015; Cabanillas et al. 2017; Costa et al. 2017; Xi and He. 2018; Villa et al. 2020).

4. Exposure Assessment

Industry perform due diligence testing for soya in wheat flour to monitor these levels. The National Association of British and Irish Flour Millers (NABIM) provided the most recent data submitted by their members between September 2015 and May 2020 which includes 369 test results. The results of testing range between 0 – 1100.7 mg/kg and included flours, eithers solely or combined, from the UK, Germany, France, Russia, Australia, Canadian, and the US. The majority of those with higher levels of soya contamination tended to be those from non-EU origin or combined with non-EU wheat flour. However, there was a small proportion of solely UK and EU origin flour with what could be deemed as high levels of soya contamination, suggesting the issue is not entirely limited to non-EU wheat flour.

FSA’s exposure assessments for allergen incidents where there is unintentional presence of an allergen due to cross-contamination in a final product to be presented to the final consumer take into account the level(s) detected, the likely consumption amounts of the product and the most appropriate population reference dose for the allergen.

As part of best practise for effective allergen management, industry take into account these factors in risk assessments for their own products and to decide what information they provide on this risk to their customer(s) and whether they would apply precautionary statements based on evidence relating to their specifics products.

The following calculations take into account the recent due diligence test data provided by NABIM and are for illustrative purposes to demonstrate the proportion of flour sampled that could produce objective symptoms in the allergic population if present and consumed in the final product if certain example reference amounts are used to arrive at an action level for the raw flour. Wheat flour is a versatile primary commodity and is used in different foods at different levels, each undergoing varying levels and types of processing. Practically, reference amounts and action levels should be determined by industry on a case-by-case dependant on the different scenarios of usage for their flours.

Example exposure calculations assuming different reference amounts/consumption levels in g of contaminated wheat flour:

- General calculation used: Detection Result (mg/g) x Reference amount (g) = Exposure dose (mg). The number of flour samples which, using this approach, would equate to a level in mg above the ED_{01} but not the ED_{05}, and above the ED_{05}, and all samples above the ED_{01} are presented. Theoretical action levels are then back calculated using the ED_{01} (0.5mg) and ED_{05} (10mg) for soya protein divided by the reference amount (g), to give mg/g level, then converted it into mg/kg levels (x1000).
- Utilising the ED_{01} and ED_{05} reference dose for soya of 0.5mg and 10mg soya protein respectively and consumption equivalent of **80g** quantity of flour, 157/367 (43%) flours sampled would be predicted (based on the ED values) to produce objective symptoms in between 1% - 5% of the allergic population and 18/367 (5%) would present a risk to greater than 5% of the allergic population. **In total 175/367 (48%) would be above the ED_{01} of 0.5mg**
    - **Effective action level of 6.3mg/kg (ppm) at ED_{01}**
    - **Effective action level of 126mg/kg (ppm) at ED_{05}**
- Utilising the ED_{01} and ED_{05} reference dose for soya of 0.5mg and 10mg soya protein respectively and consumption equivalent of **50g** quantity of flour, 148/367 (40%) flours sampled would be predicted to produce objective symptoms in between 1% - 5% of the allergic population and 5/367 (1%) would present a risk to greater than 5% of the allergic population. **In total 153/367 (42%) would be above the ED_{01} of 0.5mg**
    - **Effective action level of 10mg/kg (ppm) at ED_{01}**
    - **Effective action level of 200mg/kg (ppm) at ED_{05}**
- Utilising the ED01 and ED05 reference dose for soya of 0.5mg and 10mg soya protein respectively and consumption equivalent of **30g** quantity of flour, 118/367 (32%) flours sampled would be predicted to produce objective symptoms in between 1% - 5% of the allergic population and 1/367 (0.3%) would present a risk to greater than 5% of the allergic population. **In total 119/367 (32%) would be above the ED_{01} of 0.5mg**
    - **Effective action level of 16.7mg/kg (ppm) at ED_{01}**
    - **Effective action level of 334mg/kg (ppm) at ED_{05}**

Solely UK origin Flour:

- Utilising the ED_{01} and ED_{05} refence dose of 0.5mg and 10mg of soya protein respectively and consumption equivalent of **50g** quantity of flour, **12/146 (8%)** of solely UK flours sampled would be predicted to produce objective symptoms in between 1% - 5% of the allergic population but **none would pose a risk to greater than 5%.**

*percentages rounded to nearest whole number.

The calculations above assume no reduction in detectable soya protein levels or allergenicity from raw ingredient to final product (decrease exposure) given the variability and uncertainty associated with the extent to which this may occur. The calculations also do not factor in other potential sources of contamination of soya from other final product ingredients (increase exposure),or take into account that some of the products may have soya-containing ingredients deliberately added as part of the recipe.

Reference amounts for wheat-based products

Information provided by the Nabim states that an average slice of white bread weighs 46-54g per slice (thin/thick). According to data in the recipes database (NDNS, 2008-2016), wheat flour makes up between 50 and 60% of white bread. This was also seen to be similar for wholemeal bread. Therefore, it can be assumed that the reference amount of 30g of flour equates to approximately 1 slice of bread, 50g of flour to approximately 2 slices of bread and 80g of flour to approximately 3 slices of bread.

Furthermore, the Nabim also gives information that a plain biscuit would weigh approximately 40g when baked, while according to the recipes database (NDNS, 2008-2016) a plain digestive biscuit would be approximately 60% wheat flour. Similarly, it can be assumed that 30g of wheat flour would approximately equate to slightly more than half of one average sized biscuit, 50g of wheat flour to about three quarters of one biscuit and 80g of wheat flour to slightly more than one biscuit.

Another example is a Danish pastry/croissant, Nabim have suggested that the average weight would be circa 70 – 120g. According to the recipes database (NDNS, 2008 – 2016) a Danish pastry or croissant would be made up of between 35 and 45% wheat flour. Therefore, 30g of wheat flour would be about one small Danish pastry or croissant, 50g would be about one large Danish pastry or croissant and 80g would be approximately one small and one large pastry combined.

Table 1 shows the acute consumption of wheat flour across multiple food groups for infants 4 – 18 months), toddlers (1.5 – 3 years), young children (4 – 10 years), children (11 – 18 years), adults (19 - 64 years) and the elderly (65+ years). Consumption data from the Diet and Nutrition Survey of Infants and Young Children (DNSIYC), 2011 was used for infants, while for all other age groups data was from the National Diet and Nutrition Survey (NDNS), 2008 – 2016.

Table 1: Acute (eating occasion) consumption of wheat flour in g/ person *

Age groups	Minimum	Median	Mean	97.5th percentile	Maximum	Consumers in population group	Respondents in population group
Infants (4-18	0.22	35	39	99	150	2515	2683

months) **							
Toddlers (1.5-3years) ***	2.1	70	72	140	210	850	851
4 – 10 years***	8.4	100	110	200	480	1810	1812
11 – 18 years***	1.1	120	130	260	470	1972	1974
19 – 64 years***	0.15	110	120	270	450	3677	3702
65 + years***	0.10	96	100	200	320	1084	1086

*rounded to 2 s.f.. ** consumer-based acute consumption data from DNSIYC (2011) ***consumer-based acute consumption data from NDNS (2008-2016)

The acute consumption data for wheat flour in Table 1 shows that all age groups are on average likely to exceed 30g of wheat flour per day, those from age 1.5 years and above are likely to exceed 50g of wheat flour per day on average and those from age 4 years and above are likely to exceed 80g per day. The highest contributor to wheat flour consumption was from bread, followed by pasta, pastry, cakes and biscuits and other.

It can be seen from Table 2 that percentage exceedance of the reference amounts of wheat flour using mean acute consumption data is higher for older children and adults compared with infants and toddlers, where soya allergy is more prevalent.

Table 2 shows the percentage exceedance of the mean acute consumption for the age groups in table 1 for the reference amounts of 30g, 50g, and 80g wheat flour per day.

Table 2: Percentage exceedance of mean acute consumption of wheat flour (%)*

Age groups	30g	50g	80g
Infants (4-18 months) **	130	77	48
Toddlers (1.5-3 years) ***	240	140	90
4 – 10 years***	360	210	130

11 – 18 years***	440	270	170
19 – 64 years***	400	240	150
65 + years***	340	200	130

*rounded to 2 s.f.. ** calculated from consumer-based acute consumption data from DNSIYC (2011) ***calculated from consumer-based acute consumption data from NDNS (2008-2016)

Table 3 demonstrates that the percentage exceedance of the reference amounts of wheat flour for the higher consumers is high for all age groups for the 30g and 50g reference amounts, except for infants for the highest reference amount of 80g

Table 3 shows the percentage exceedance of the 97.5th percentile acute consumption for the age groups in table 1 for the reference amounts of 30g, 50g, and 80g wheat flour per day.

Table 3: Percentage exceedance of 97.5th percentile acute consumption of wheat flour (%)*

Age groups	30g	50g	80g
Infants (4-18 months) **	180	110	68
Toddlers (1.5-3 years) ***	690	280	170
4 – 10 years***	670	400	250
11 – 18 years***	870	270	170
19 – 64 years***	900	540	340
65 + years***	660	400	250

*rounded to 2 s.f.. ** calculated from consumer-based acute consumption data from DNSIYC (2011) ***calculated from consumer-based acute consumption data from NDNS (2008-2016)

Finally, Table 4 shows the percentage of consumers in each age group who (based on acute consumption data) are consuming ≥ the reference amounts of 30g, 50g and 80g wheat flour per day.

Table 4: Percentage of consumers consuming ≥ the reference amounts of wheat flour per day based on acute consumption (%)*

Age groups	≥30g	≥50g	≥80g
Infants (4-18 months) **	54	27	6.5
Toddlers (1.5-3 years) ***	94	78	35
4 – 10 years***	99	94	75
11 – 18 years***	99	96	83
19 – 64 years***	97	92	76
65 + years***	98	92	67

*rounded to 2 s.f.. ** calculated from consumer-based acute consumption data from DNSIYC (2011) ***calculated from consumer-based acute consumption data from NDNS (2008-2016)

Table 4 demonstrates that as the reference amount increases there are fewer consumers exceeding it. It supports that older age groups are more likely to eat more than the reference amounts than the younger age groups.

It is important to note that the acute consumption values are derived from a distribution of the highest consumption in one sitting that occurs over the 4 day food diary for each wheat flour consumer in the NDNS and DNSIYC surveys, however an average is taken from that distribution for each of the age groups described. Therefore, we have considered minimum, mean, maximum and 97.5th percentile values to look at average and high-level data. The median has also been included to give an idea how skewed the data are, which is deemed to be low. An allergic reaction tends to occur following consumption of a meal or food in one eating occasion, the consumption data presented is the highest amounts consumed in one sitting throughout one day over the recording period so may not reflect the exact situation for an allergic consumer. However, these data are useful to give an estimation of the likely level of exceedance of the reference amounts of wheat flour in different age groups.

To FSA's knowledge, there are no data available in relation to testing results for different final products made using wheat flour with known levels of soya protein. These data could provide support or challenge to the hypothesis that processing reduces the detectable levels of soya protein that would be expected in flour-based final product as sold to the consumer and therefore pose a lower risk to the soya allergic population than currently estimated. However, previous studies have supported this occurrence in various food matrices (Amigo-Benavent et al. 2008; Gomaa & Boye. 2013).

5. Risk Characterisation

The prevalence of soya allergy in the UK population is mostly unknown but some prevalence data is available that suggests 0.4% of children up until the age of 2 years have soya allergy, for adults it is unknown but likely to be less. There is currently no UK surveillance system to further estimate the prevalence in the population of reactions to soya or the severity of those allergic reactions.

Wheat flour milled in the UK contains adventitious soya contamination arising from cross contamination in the field (for non-UK wheat) or later in the process such as during milling or transport. There are different concentrations of adventitious soya in wheat flour found in industry sampling data.

- UK flour millers are currently using an action level of 236mg/kg, and sampling data indicates that only 1% of wheat flour is over this level and would require precautionary statements.
- However, using the most up to date published eliciting doses to inform action levels would mean that, if using the ED01 as the reference dose, 32-48% or more of flours would be over this limit, depending on the reference amount in final products.

Wheat flour is most often consumed as a cooked end product such as biscuit, bread or cake. During this process the concentration of soya in the flour will be diluted with other ingredients and there is considerable variability between different end products as to that dilution factor. The raw food mixture may be diluted to a level below the action level.

Thermal processing of the raw mixture to provide the cooked end product is likely to degrade soybean allergens. However, there is a significant data gap in the reduction factor to be applied to allergenicity that could be used in a risk assessment given the variability of cooking time and temperatures between different product types and a lack of basic information of thermal rate of decay and soya allergen reduction. This effect cannot be simply quantified but suggests that action levels for soya in wheat flour could take this into account when considering an appropriate and proportionate reference dose used to inform these action levels.

Estimate of the number of UK allergic reactions using each action level

Due to lack of prevalence data for adults, and the variability between final products for the proportion of wheat flour contained over the different action levels discussed, and the lack of quantitative data on the reduction brought about by thermal processing of end products, it is not possible to arrive at an estimate of the number of incidences expected for the different action levels at this time.

Consumption data shows that a higher reference amounts than have been demonstrated here may be more suitable which would increase the amount of flours requiring application of precautionary statements.

Ultimately, information on the risk of unintentional allergen presence due to cross-contamination informs decision on precautionary allergen statements throughout the supply change and labelling on the final product. Precautionary allergen labelling (PAL) is used as a control measure to prevent the inadvertent consumption of undeclared allergens by sensitive consumers and enable a variety of safe and nutritious food choices for the allergic consumer. Precautionary allergen labelling should only be used if the risk of allergen cross-contamination is real and cannot be removed in order to prevent unnecessarily restricting the availability of food to sensitive individuals. The proportion of soya allergic consumers who would not consume food products labelled for soya is not known. The evidence regarding which consumers are most likely to adhere to PAL statements is mixed. While some studies report those with more severe allergies or those with a child with allergies are more likely to be cautious regarding products with PAL (Cornelisse-Vermaat et al. 2007; Ben-Shoshan et al. 2012; Cochrane et al. 2013; DunnGalvin et al. 2019), other studies report no significant differences in adherence to PAL based on consumer characteristics (Noimark et al. 2009; Barnett et al. 2011; Zurzolo et al. 2013).

Estimating the severity of reactions

Severity of reactions to soya are mixed but tend to be less severe when compared to outcomes from other food allergies and data on incidence of reactions in the UK and knowledge of their exact trigger is lacking. We assume that the level of severe reactions is unlikely to be high, otherwise we would expect to see more reactions being reported via hospitalisations or in the case literature. However, absence of evidence is not necessarily evidence of absence. Eliciting dose levels have been developed to enable predictions of the proportion of the allergic population who would be expected to experience adverse reactions to different dose levels.

Questions on which views of the Committee are sought

- What scientific factors associated with risk of an allergen should be taken into account when setting an actionable limit/action levels at the raw/bulk ingredient supply level?
- Is it possible or appropriate for a single reference amount to be used to inform action levels for soya in wheat flour, or should a specific risk assessment always be conducted for each food product to be produced using the flour?

Considering the effects of processing on the allergenicity and detectability on soya allergens and the potential reduction of risk to the allergic population that final products from these flours may pose, would the ED05 be a more appropriate reference dose to use than the ED01 to inform action levels for raw flour by industry?

6. References

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7. Appendices

A. Table 1: WHO/IUIS registered soybean allergens (adapted from Cabanillas et al. 2017) http://www.allergen.org/search.php?Species=Glycine%20max

Super family	**Protein family**	**Allergen name(s)**
Prolamin	Hydrophobic, soybean hull protein	Gly m 1
Scorpion, toxin-like, knottin	Defensin	Gly m 2
Profilin	Profilin	Gly m 3
Bet v 1-like	Bet v 1 family	Gly m 4
Cupin	7s globulin	Gly m 5
Cupin	11s globulin	Gly m 6
Unspecified	Seed biotinylated protein	Gly m 7
Prolamin	2s albumin	Gly m 8