

The Consequences of Precautionary Allergen Labeling: Safe Haven or Unjustifiable Burden?



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Precautionary allergen labeling (PAL) also known as “may contain” labeling has been applied to many packaged food products around the world. PAL is a voluntary form of labeling whose original intent was to help ensure that packaged foods were as safe as possible for allergic consumers by alerting them to the possible presence of allergen residues resulting from the use of shared processing equipment, shared processing facilities, or other industry practices. However, the proliferation of PAL and the myriad of various phrasing used as PAL statements are confusing to consumers and serve to diminish their quality of life. Thus many allergic consumers are known to ignore PAL statements. Analytical surveys indicate that many PAL products contain no detectable allergen residues and are likely safe for allergic consumers. However, up to 8% of allergic consumers report having had reactions to the ingestion of PAL products. Clearly a better approach to labeling is needed that balances the health and safety considerations of allergic consumers with their desire to enjoy the widest possible array of foods available in the marketplace. This article presents an overview and discussion of the shortcomings of the current PAL system and explores why a new approach is required. © 2018 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2018;6:400-7)

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Patients with food allergies manage their condition by the complete avoidance of all foods that contain their causative allergen(s). Because food consumption is associated with variable risk in differing situations, these patients can experience a

diminished quality of life as they struggle to maintain a safe and effective allergen avoidance diet.¹ Food-allergic patients or their caregivers rely heavily on the ingredient declarations on packaged food products to determine safe food choices.² They are advised to avoid consumption of packaged foods that have mandated labels that declare the presence of the food that they are allergic to. Although this mandatory form of label declaration is pivotal to the safety of these patients, food-allergic consumers also face management of a second form of labeling called precautionary allergen labels (PAL). The use of PAL has become increasingly widespread in recent years. There are many questions raised by this second form of labeling because it is not currently regulated or standardized and some manufacturers employ them on an *ad hoc* basis. So what do PAL labels really mean? Do food-allergic patients really need to avoid all foods with PAL statements? Are products with PAL statements safe to eat? Are these statements required by regulation? Are they even helpful? Although well intentioned at the outset, there is emerging evidence that a rational approach to the interpretation of PAL statements is difficult for consumers and health care professionals alike. This article aims to explore the issues surrounding PAL statements and seeks to understand if there is a better path forward.

REGULATORY STATUS OF LABELING OF ALLERGENIC FOODS

A large number of countries have enacted legislation mandating the labeling of the most common allergenic foods on packages, but only when these foods or ingredients derived therefrom are used as intentional components of the formulation.³ Although the list of foods requiring mandatory labeling varies by country to some extent, peanuts, tree nuts, milk, eggs, crustacean shellfish, fish, soybeans, and cereal sources of gluten are found on the lists in most of these countries in accordance with recommendations first made by the Codex Alimentarius Commission in 1999.³

Previously, food labeling regulations permitted the undeclared use of certain intentional ingredients derived from allergenic foods if they had no technical or functional effect in the finished food product (defined as processing aid). Examples of processing aids would include the use of soy lecithin as a release agent to prevent baked goods from sticking to processing equipment or the addition of fining agents made from milk, egg, and fish to clarify beverages. In addition, certain ingredients derived from allergenic sources were allowed to be declared in collective terms such as “natural and artificial flavors” or “spices.” Finally, many ingredients were previously declared by a name that did not identify the food source such as casein or whey (milk) or semolina (wheat).

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Abbreviations used

CFR- Code of Federal Regulations

EU- European Union

FALCPA- Food Allergen Labeling and Consumer Protection Act

FDA- Food and Drug Administration

GMP- Good Manufacturing Practices

PAL- Precautionary allergen labels

VITAL- Voluntary Incidental Trace Allergen Labeling

This situation changed in many countries with the increased awareness of food allergies that began to occur in the mid-1990s. In the United States, the Food and Drug Administration (FDA) wrote an open letter to the food industry in 1996 indicating that food manufacturers must declare the allergenic source on the ingredient statement of any packaged food where a processing aid derived from a commonly allergenic source was used (www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/Allergens). Subsequently, allergen labeling regulations were enacted in the United States and many other countries to require that all ingredients derived from commonly allergenic sources be declared by the allergenic source on food labels unless regulatory authorities ruled them as exempt from source labeling requirements.³ Such exemptions are variable around the world, but the ingredients that are exempt in some countries (but perhaps not others) pose low, if any, risks to food-allergic consumers.⁴⁻⁷ In the United States, highly refined oils derived from peanuts or soybeans are exempt from source labeling as directed by Congress when they passed the Food Allergen Labeling and Consumer Protection Act (FALCPA). A petition process for source labeling exemptions was implemented in the United States with the passage of FALCPA, but thus far the U.S. FDA has only exempted certain uses of specific formulations of soy lecithin for use as stick-release agents on processing equipment when applied directly to the equipment. The European Union (EU) has established source labeling exemptions for several ingredients derived from commonly allergenic sources including cereal sources of gluten, nuts, and whey used for making distillates or ethyl alcohol; soybean oil; tocopherols (vitamin E), phytosterols, and plant stanol esters made from soybeans; glucose syrups made from wheat and barley; dextrose and maltodextrin made from wheat; lactitol (from milk); fish gelatin as a carrier for vitamin or carotenoid preparations and fish gelatin or isinglass used as a fining agent for beer and wine (www.foodallergens.info/Legal/Labelling/Exemptions.html). Australia and New Zealand have exempted the following ingredients from source labeling: glucose syrup made from wheat, soybean oil, tocopherols and phytosterols made from soybeans, distilled ethyl alcohol from wheat or whey, and isinglass from fish used in clarification of wines (www.allergenbureau.net/new-allergen-labelling-exemptions-australia-new-zealand-example-industry-collaboration).

Although mandatory labeling of commonly allergenic foods aids food-allergic consumers, such labeling does not cover the unintended inclusion of allergens that can often occur because of cross-contact from the shared use of processing equipment (a common practice in the food industry) or agricultural comingling.⁸ Accordingly, the food industry has widely adopted the voluntary use of PAL to alert consumers to the possible unintended presence of allergens. PAL statements are not mandated by regulation, but their use is voluntarily allowed in most

TABLE I. Some phrases used in precautionary allergen labeling

Phrases
May contain "X"
"X" may be present
Not suitable for "X" allergy sufferers
Manufactured on shared equipment with "X"
Manufactured in a shared facility with "X"
Packaged in a shared facility with "X"
May contain the occasional nut
May contain any allergen not present in the ingredient statement
May contain allergens
Allergens may be present
Carefully baked in a nutty environment

countries. From a regulatory perspective, PAL statements must only meet the criteria that they should be truthful and not misleading (Code of Federal Regulations, Title 21, Part 101, Sec. 101.18—Misbranding of food).

PRECAUTIONARY ALLERGEN LABELING AND ITS USE BY THE FOOD INDUSTRY

The adoption of PAL also coincided with the increased awareness of food allergies by the food industry in the mid-1990s and the associated rise of both the prevalence and rates of hospital admissions for anaphylaxis to foods.⁹⁻¹¹ With no guidance from regulatory/public health agencies on threshold levels for allergenic foods, food companies increasingly chose to inform allergic consumers about the potential unintentional allergen presence by applying PAL statements. Increased usage of PAL ensued over the subsequent years with evidence in Australia that at least 65% of all edible packaged goods in a supermarket setting have some form of PAL labeling.¹² Because PAL is used voluntarily by the food industry, many different PAL phrases have appeared on package labels (Table I). In Australia, the mix of various PAL phrases has been quantified over the years with "may contain traces of" (29.0%), "may be present" (12.7%), and "made on the same production line" (12.1%) as the most common.^{12,13}

The food industry makes very frequent use of shared processing equipment and/or facilities across almost the entire range of food product categories.¹⁴ Smaller companies with a diverse range of product formulations often have to use shared equipment with more frequency than larger companies. Larger companies with very popular brands can sometimes devote a processing line to only 1 or a few highly related products. But a small gourmet chocolate manufacturer might well use shared equipment that processes milk, eggs, peanuts, tree nuts, wheat, and soybeans. As such it can be difficult to manage the control of cross-contact of these allergens—particularly when cleaning chocolate lines is a complex and tedious process.

The removal of residues of allergens from shared processing equipment surfaces can be quite difficult in some circumstances. The equipment can be large and disassembly for more effective cleaning can be time consuming. For some food categories, water cannot be used for cleaning. In bakery operations for example, the use of water would lead to mold growth and in chocolate processing, the use of water encourages the growth of pathogenic bacteria. Food residues can, on occasion, be difficult to remove because of stickiness (eg, peanut butter, chocolate) or the

TABLE II. Analytical surveys of packaged foods with and without precautionary allergen labels

Publication	Food type	Allergen	No. of samples with detectable level of allergen residue/total no. of samples (%)	
			With PAL	No allergen declaration
Pele et al, 2007, ¹⁶ EU	Cookies	Hazelnut	34/109 (31.2%)	42/169 (24.9%)
	Cookies	Peanut	34/157 (24.8%)	17/159 (10.7%)
	Chocolate	Hazelnut	141/182 (77.5%)	21/40 (52.5%)
	Chocolate	Peanut	79/196 (40.3%)	13/52 (25.0%)
Hefle et al, 2007, ¹⁷ USA	Various	Peanut	20/200 (10.0%)	ND
	Chocolate	Peanut	7/36 (19.4%)	ND
	Nutrition bars	Peanut	4/28 (14.3%)	ND
Ford et al, 2010, ¹⁸ USA	Various	Egg	1/57 (1.8%)	3/117 (2.6%)
	Various	Milk	6/59 (10.2%)	4/134 (3.0%)
	Various	Peanut	5/112 (4.5%)	0/120 (0%)
Crotty and Taylor, 2010, ¹⁹ USA	Various	Milk	34/81 (42.0%)	ND
	Chocolate	Milk	14/18 (77.8%)	ND
López-Calleja et al, 2013, ²⁰ Spain	Various	Hazelnut	44/61 (72.1%)	40/89 (44.9%)
López-Calleja et al, 2013, ²¹ Spain	Various	Peanut	28/30 (93.3%)	27/73 (37.5%)
de la Cruz et al, 2013, ²² Spain	Chocolate	Brazil nut	1/15* (6.6%)	2/19† (10.5%)
Remington et al, 2013, ²³ USA	Various	Peanut	6/186 (8.6%)	ND
Robertson et al, 2013, ²⁴ Ireland	Various	Peanut	2/18 (11.1%)	ND
Zurzolo et al, 2013, ²⁵ Australia	Various	Peanut	7%	ND
		Milk	0%	ND
		Egg	0%	ND
		Soybean	0%	ND
López-Calleja et al, 2014, ²⁶ Spain	Various	Almond	26/63 (41.3%)	50/123 (40.6%)
López-Calleja et al, 2014, ²⁷ Spain	Various	Pistachio	6/69 (13.0%)	29/149 (19.5%)
Remington et al, 2015, ²⁸ England	Various	Milk	8.2%	ND
		Gluten	6.1%	ND
		Hazelnut	2.9%	ND
López-Calleja et al, 2015, ²⁹ Spain	Various	Walnut	30/79 (38.0%)	79/141 (56.0%)
	Various	Pecan	10/79 (12.7%)	18/107 (16.8%)
López-Calleja et al, 2015, ³⁰ Spain	Various	Cashew	27/64 (42.2%)	26/130 (20.0%)
	Various	Macadamia nut	14/63 (22.2%)	22/143 (15.4%)
López-Calleja et al, 2015, ³¹ Spain	Various	Sesame seed	17/35 (48.6%)	10/190 (5.2%)
de la Cruz et al, 2015, ³² Spain	Various	Almond	4/60 (6.7%)	1/15 (6.7%)
Khuda et al, 2016, ³³ USA	Baked goods	Egg	10/80 (12.5%)—MO‡	23/363 (6.3%)—MO‡
			5/80 (6.3%)—RB§	5/363 (1.4%)—RB§
	Snacks	Egg	1/21 (4.8%)—MO‡	8/371 (2.2%)—MO‡
Khuda et al, 2016, ³⁴ USA	Baked goods	Soybean	0/21 (0%)—RB§	1/371 (0.3%)—RB§
			10/73 (13.7%)—ES	32/211 (15.2%)—ES
			14/73 (19.2%)—NE¶	41/211 (19.4%)—NE¶
Cristina et al, 2016, ³⁵ Italy	Various	Milk	0/2 (0%)	0/2 (0%)
Bedford et al, 2017, ³⁶ USA	Dark chocolate	Milk	43/59 (72.9%)—NE**	4/12 (33.3%)—NE**
			44/59 (74.6%)—MO††	4/12 (33.3%)—MO††

ND, Not done; PAL, precautionary allergen label (text of PAL statement varies).

*Products with PAL specifically mentioning Brazil nut.

†Products with PAL mentioning nuts in general.

‡MO: analyzed with the Morinaga Egg ELISA kit.

§RB: analyzed with the r-Biopharm Ridascreen Egg ELISA kit.

||ES: analyzed with the ELISA Systems Soybean ELISA kit.

¶NE: analyzed with the Neogen Veratox Soybean Allergen ELISA kit.

**NE: analyzed with the Neogen Veratox Total Milk ELISA kit.

††MO: analyzed with the Morinaga Milk ELISA kit.

TABLE III. Analytical surveys of packaged foods with and without gluten-free labels

Publication	Food type	No. of samples with detectable level of allergen residue/total no. of samples (%)		
		Gluten-free	PAL	Non-gluten-free*
Gelinas et al, 2008, ³⁷ Canada	Various cereal-based	7/77 (9.1%)		16/71 (22.5%)
Koerner et al, 2011, ³⁸ Canada	Oats			124/133 (93.2%)
Lee et al, 2014, ³⁹ USA	Various	16/78 (20.5%)		
Sharma et al, 2015, ⁴⁰ USA	Various	3/275 (1.1%)		19/186 (10.2%)
Thompson, 2016, ⁴¹ USA	Various	1/14 (7.1%)		13/87 (14.7%)
Verma et al, 2017, ⁴² Italy	Various	2/93 (2.2%)	4/36 (11.1%)	19/186 (16.9%)

PAL, Precautionary allergen label (may contain traces of gluten).

*Products in this category were typically selected from food categories that might be assumed by gluten-sensitive consumers to be naturally gluten-free but did not have such a claim on the label.

presence of particulates. The food industry also struggles to determine if their attempts to clean shared equipment are sufficient. How clean is clean enough? With the lack of regulatory and public health agency guidance on threshold doses, the food industry is likely to err on the side of caution.

Food manufacturers are required to follow Good Manufacturing Practices (GMP) under Title 21, Part 110 of the Code of Federal Regulations (CFR). However, the GMP provisions are rather generally stated and not specific to selected pieces of equipment and manufacturing operations. As just 1 example from the CFR (paragraph 117.80): “Raw materials and other ingredients that are food allergens and rework that contains food allergens must be held in a manner that protects against allergen cross-contact.” The Food Safety Modernization Act passed in the United States in 2011 requires the food industry to have validated allergen preventive controls, but guidance to industry remains incomplete and enforcement has only recently begun on a limited basis.

The impact of PAL on legal liability is uncertain and has not been thoroughly tested in court proceedings.¹⁵ The central question is whether PAL statements provide an adequate warning to food-allergic consumers.

RISK ASSESSMENT OF FOODS BEARING PAL

Should products with PAL statements be avoided? Are they safe to consume? Several analytical surveys have been conducted on foods with PAL statements that have yielded somewhat variable results (Table II). Several of the analytical surveys demonstrate that many food products with PAL statements contain no detectable allergen residues.¹² Although this observation implies that food manufacturers are overusing PAL, the lack of establishment of thresholds for PAL use by public health authorities and regulatory agencies plays a large role in this generous use of PAL. Food manufacturers are not well equipped to determine safe, tolerable levels of allergen residues and thus apply PAL even in circumstances where there is no detection of allergen residues. Furthermore, public health authorities have not formally endorsed the safety of allergen residue levels below the detection limits of the existing analytical methods. For many of the analytical surveys portrayed in Table II, only 1 or 2 samples of each product were analyzed; that may be insufficient in circumstances where the allergen residues were not uniformly distributed as might happen with particulates. Obviously, there are practical limitations to the number of samples of each product that can be analyzed. PAL statements should not necessarily be interpreted to imply that allergen residues are evenly distributed either within or between production lots.

The number of products with PAL that have been analyzed for allergen residues remains rather small in light of the enormous number of products in the marketplace with PAL statements. Several of the surveys were conducted on a wide range of products within a particular food category such as cookies and chocolate for hazelnut and peanut in the EU,¹⁶ milk in dark chocolate in the United States,^{19,36} soy in baked goods in the United States,³⁴ and snack foods for various allergens in Australia.²⁵ However, reliance on these observations should be tempered by the possibility of bias in the selection of products. Geographic differences in the likelihood of detecting allergen residues in products with PAL appear to exist (Table II). Detection of allergen residues occurred more frequently with products from the continental part of the EU^{20,21,29,30} compared with the United States, England, Ireland, and Australia.^{17,18,23-25,28} Only 1 repeated survey has been done that showed that the frequency of finding detectable peanut residues in foods with PAL did not change in the United States between 2005 and 2009.^{17,23} The likelihood of finding detectable allergen residues is higher with certain foods than with others. For example, the risk of detecting milk residues in dark chocolate is quite high regardless of whether PAL is used or not.^{19,36} Dark chocolate is probably the riskiest product with PAL because shared equipment is very frequently used, the shared equipment is exceedingly difficult to clean between milk and dark chocolate, and the viscous nature of chocolate results in persistent levels of detectable milk residues in dark chocolate over time after changeover (personal observation by S. Taylor).

The choice of allergen detection methodology such as the type of ELISA kit used may also impact the likelihood of finding detectable allergen residues in foods with PAL.³³ This phenomenon was most clearly demonstrated by the finding of detectable levels of egg more frequently in products, especially baked products, with precautionary egg labels when using the Morinaga Egg ELISA kit as opposed to the r-Biopharm Ridascreen Egg ELISA kit (Table II). The Morinaga Egg ELISA kit is known to have a more aggressive protocol for the extraction of egg from heat-processed foods.

One key insight from an examination of Table II is that food-allergic consumers appear almost as likely to encounter a food with detectable allergen residues if they select foods with no PAL as opposed to foods with PAL. However, the investigation of foods with no PAL in the studies outlined in Table II likely involved the selection of foods that had some likelihood of being manufactured on shared equipment with products containing the allergen in question. Thus selection bias undoubtedly

contributed to the comparative findings. Clearly, though, some categories of foods are likely to be very safe choices for food allergic patients such as fresh meats or fresh fruits and vegetables for obvious reasons, foods that were not analyzed as part of the surveys presented in Table II.

WHAT ABOUT “FREE-FROM” FOODS?

Another trend in labeling of packaged foods is the advent of foods with “free-from” statements. Among such foods, gluten-free food is the most prevalent example. In many countries, the use of the term “gluten-free” is regulated and such foods are not allowed to contain gluten levels above some proscribed amount (<20 ppm is the most common definition). Several analytical surveys have been conducted on gluten-free foods (Table III) with variable results. However, sample selection bias may have contributed to the disparity in results. These results clearly show that products with gluten-free statements sometimes contain levels of gluten above 20 ppm. But certain products without gluten-free labels are even more likely to contain detectable gluten levels even if sources of gluten-containing grains or ingredients are not obvious on the ingredient statement. Oats and oat-based products without gluten-free statements, for example, are very likely to contain detectable levels of gluten because of agricultural comingling with gluten-containing grains such as barley, wheat, and durum wheat/semolina.³⁸

PATIENT BEHAVIOR AND CONSEQUENCES

Avoidance of foods with PAL places an additional burden on the allergic consumer, with evidence that shoppers who avoid products with PAL spend more time identifying suitable foods, and pay on average more than their nonallergic counterparts.⁴³ The widespread use of PAL causes considerable confusion and anxiety in people with allergies and their caregivers, and it is not uncommon for consumers to miss allergy warnings altogether. The use of different wording on advisory statements is confusing and may contribute to the increasing trend for consumers to ignore them altogether.

Consumer misconceptions about PAL are widespread.^{8,44,45} Some consumers believe that such labeling is mandatory and regulated,⁴⁵ whereas in fact, PAL is voluntary and loosely regulated at best. Consumers also sometimes believe that PAL is based on the amount of allergen present in the food,⁴⁵ and others that the amounts of allergen residues remaining in foods with PAL statements should always be low. That is not always true as unintended particulate allergens can be as large as a whole peanut in some circumstances. In addition, consumers believe that allergen residue levels should be consistent in products bearing PAL statements. However, in many cases, the allergen residue levels are quite variable. Safely eating a PAL product on one occasion does not mean that eating the same product on subsequent occasions will be safe in all circumstances.

A survey of young food-allergic adults in the United States in 2006 reported that the majority ignored “may contain” statements⁴⁶; similar results were obtained from a small group of UK teenagers.⁴⁷ More recent surveys of food-allergic consumers in the United States and Canada revealed that up to 40% purchased products with PAL.^{45,48} A UK-based survey found that many parents of children with nut allergies avoided products labeled “may contain traces,” but less did so when less direct statements were used—for example, “made in a factory that uses nuts.”⁴⁹

Consumers in the United States and Canada also similarly indicated variable avoidance of PAL depending on the wording of the PAL phrase.^{17,45,48,50} Some food-allergic consumers in Japan,⁵¹ Canada,^{50,52} and Australia⁵³ are also reported to ignore PAL. The reasons for such behaviors are likely complex and require further investigation. Furthermore, there is evidence that consumers are ignoring labeling irrespective of whether they have a history of prior anaphylaxis—patients who might be expected to be more cautious with avoidance of foods with PAL.²⁵

One study cataloged factors considered by nut-allergic patients regarding PAL.⁵⁴ Many claimed that PAL labeling was not credible or desirable. Clearly, one or more of these factors prompted some consumers to take risks in choosing to purchase some products with PAL:

- (1) PAL is so prevalent that one cannot avoid eating food products with them.
- (2) PAL was seen as being used to “protect” the manufacturer from any claims arising from an allergic reaction due to cross-contamination.
- (3) More “wordy” PAL was interpreted as implying a lower risk, and could therefore be consumed by those who avoided products with more direct “may contain” labels.
- (4) Implausibility, when, for example, PAL to nuts appeared on a packet of peanuts, the implication being that PAL are not rationally or reliably applied by manufacturers.

Interpretation and consequent decisions were not only based on the detail of labeling but also on external factors such as the nature of the product, any discounts on the product, the perceived trustworthiness of the producer, and on the previous experience of the nut allergic individual (eg, if they had already bought and consumed products with this type of labeling with no reaction). Some consumers would ignore the labeling if they “liked” the food product and they felt that any consequential reaction would only be mild in severity.

Although several studies have shown that allergic consumers would ignore PAL statements under various circumstances,^{46,47,55} few studies have been conducted to evaluate the risk associated with ingestion of a product bearing PAL statements by allergic consumers. In a Canadian survey of 1454 food-allergic individuals, 651 respondents reported having had 1 or more allergic reactions to packaged food products.⁵⁶ Of these 651 respondents, 8.3% reported experiencing allergic reactions from consuming products with PAL statements. In a smaller study, among 26 allergic teenagers from Scotland who reported ignoring PAL statements, only 1 individual reported an allergic reaction.⁵⁷ However, a fatality was reported in Poland from a peanut-allergic child consuming chocolate with a PAL statement about peanuts.⁵⁸ Clearly, there is evidence that ignoring PAL can have serious consequences.

CLINICAL ADVICE TO PATIENTS REGARDING PAL

Recent years have seen a growing awareness of these issues among the clinical community, although practice varies about the advice given to patients about the avoidance and safety of foods with PAL.^{59,60} Health professionals charged with advising the allergic consumer are faced with the same issues as the consumer when interpreting the current situation. The lack of clear and consistent advice from health professionals about foods with PAL is understandable given the data presented in Table II.

Drawing practical advice for food-allergic patients from the data presented in Table II is currently impossible beyond the advice that milk-allergic individuals should avoid dark chocolate unless they know that it is made on dedicated equipment. The voluntary, unregulated implementation of PAL by the food industry is highly variable. Furthermore, the number of food samples with PAL that have been analyzed for allergen residues (Table II) is quite low when compared with the large volume of foods manufactured with PAL. Thus, any advice to ignore PAL should be dispensed with caution. Even though some health professionals advocate that certain food-allergic patients can ignore PAL, such advice can be risky especially in certain situations, for example, milk in dark chocolate, although further studies are merited to determine the extent of the risk.

The widespread industry use of ingredients made from a few of the commonly allergenic foods (milk, wheat/gluten, eggs, and soybean) makes avoidance of these foods more difficult for allergic individuals. Their burdensome avoidance diets are further complicated by the widespread use of PAL statements including these foods. With the widespread use of these ingredients and the widespread use of shared processing equipment, PAL statements can easily be made for these allergenic foods. However, the risks associated with ingestion of these foods can be quite variable and dependent on the provoking threshold dose for the individual patient.

Patients with allergies to peanuts and tree nuts need to be most vigilant about certain categories of food products (baked goods, snacks, and chocolate) where particulate nut pieces can present a risk. PAL is often applied to such products. Where PAL conveys the possibility of particulate contamination (difficult to discern by consumers or health professionals), the risks associated with ingestion of such products will be higher than for many other products with PAL.

Although further analytical surveys of foods with and without PAL and additional studies of the risks associated with ignoring PAL statements could help to clarify the current situation, global efforts to define threshold levels of allergens along with validated allergen detection methods are essential to provide a risk-based approach to PAL that could be understood and used by health care professionals in advising their patients.

A BETTER PATH FORWARD

Consensus has been achieved among various stakeholders, including consumers, food industry management professionals, health care professionals, psychologists, food industry auditors, analysts, and regulatory professionals, that PAL has lost its credibility because of its inconsistent application and lack of association with the actual risk.¹ PAL should bear a relationship to the actual risk and the decision-making criteria for application of such labeling should be transparent to all stakeholders.¹ Furthermore, if PAL is applied according in some risk-based coordinated manner, then some mechanism should be provided on the food label to indicate that the food has been evaluated for PAL but that no PAL statement is needed. Otherwise, food-allergic consumers will never know whether the packaged food lacks a PAL statement because it does not need one or because the food manufacturing company did not apply the risk assessment process.

The U.S. National Academy of Medicine has proposed a better future path for the use of PAL using a risk-based

approach.⁶¹ This approach was pioneered by the Allergen Bureau of Australia and New Zealand. The Allergen Bureau established a scientific expert panel to examine clinical data on individual threshold doses and to use dose-distribution models to develop population thresholds or Reference Doses.⁶² The Reference Doses were established based on the exposure levels that would be predicted from oral clinical challenges to elicit objective responses in small percentages of the populations allergic to specific foods (the 1% level where enough data were available and the 95% lowest confidence interval of the 5% level where lesser data were available). The use of individual threshold data obtained from escalating oral challenges of food-allergic patients in clinical settings to establish population thresholds and Reference Doses for each allergenic food has further been endorsed by the International Life Science Institute-Europe and the U.S. National Academy of Medicine.^{61,63} Existing oral challenge data from multiple clinics have established that a wide range of individual threshold doses exist for each allergenic food.⁶² For peanut for example, individual threshold doses can range from 0.4 mg (approximately 1/1000th of a peanut) up to 8 g (20 peanuts) or more.^{64,65} The Reference Dose for peanut established by the Allergen Bureau is 0.2 mg peanut protein (0.8 mg peanut), the predicted dose (ED01) based on dose distribution modeling that would elicit objective reactions in 1% of the peanut-allergic population.⁶² Recently, the validation of the Reference Dose for peanut was attempted using the administration of a single dose of peanut, the dose (ED05) predicted to elicit objective reactions in 5% of the peanut-allergic population.⁶⁶ Only 2.3% of the patients in the study had objective reactions indicating that the Reference Dose established by the Allergen Bureau was conservative. With the mild, transitory nature of the objective responses observed to peanut in the single dose trial, an argument could be made to increase the Reference Dose to the ED05 but the Allergen Bureau has not yet taken such action.

From a practical perspective, the implementation of a risk-based approach would require that patients would know their individual threshold doses. The food industry would need to use appropriate analytical methods to determine the concentration of protein residues from the allergenic source in foods being considered for PAL. The analytical information together with knowledge of the likely consumption levels of the specific foods would allow the food industry to predict the range of exposure doses to the food in question. If the food likely had allergen levels above the Reference Dose, then PAL would be recommended. If the food had residual allergen levels well above the Reference Dose (eg, dark chocolate with milk), then a stronger PAL statement could be considered. But if the food had allergen levels below the Reference Dose, then PAL would be prohibited or discouraged. In this manner, the usage of PAL would be directly linked to potential risk in a manner that is transparent to consumers and health care professionals. In Australia, the Reference Doses underpin the VITAL (Voluntary Incidental Trace Allergen Labeling) program established by the Allergen Bureau to encourage the food industry to use a risk-based application of PAL. The overall VITAL program is quite comprehensive and extends beyond the establishment of Reference Doses. From our perspective, the establishment of Reference Doses and their use in decision making about PAL usage is the critical first step on the better path forward.

CONCLUSION AND CRITICAL OPINION

PAL fails to provide useful information to consumers with food allergies. In our opinion, the food industry urgently needs public health guidance to ensure that PAL is a useful and user-friendly strategy. Although the use of Reference Doses to guide PAL usage offers a better path forward, the adoption of the VITAL program by the food industry even in Australia and New Zealand has been uneven. The Allergen Bureau is not a government agency and has no regulatory or public health status. Without the adoption of Reference Doses by public health authorities in various countries, the food industry appears to be reluctant to adopt a risk-based approach to PAL usage. The better path forward is prevented unless or until public health authorities offer guidance on tolerable risk levels to the global food industry. In our opinion, although questions may remain about the use of a risk-based approach to PAL usage, its global adoption would be a major improvement over the status quo.

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