



Review

Investigation of undeclared food allergens in commercial Thai food products

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ABSTRACT

This study investigates the presence of undeclared allergens – namely milk, egg, wheat and peanut – in commercial processed food products in Thailand. Out of 142 commercial products, 55 positive cases were found (by quantitative ELISA method) to contain an undeclared allergen greater than 10 ppm. Among all positive products, undeclared milk appeared the most frequently (21 cases), followed by egg and wheat with similar frequency (17 cases), while peanut was rarely found. Milk- or egg-positive products were further confirmed by the presence of the milk protein, casein, or the egg protein, ovalbumin, by Western blot test. Our results should help to increase the awareness among Thai food manufacturers of the need for more careful management of allergenic food ingredients, and to encourage the labeling of allergen information for allergic consumers, thus reducing the health hazard from food allergy.

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1. Introduction

It is well recognized that food allergy has become a major health concern worldwide, especially in industrialized countries. It has been estimated that around 1–2% of the population, and up to 8% of children, suffer from food allergy (Bousquet et al., 1998; Helm & Burks, 2000; Jansen et al., 1994), with symptoms ranging from relatively mild to severe, or sometimes even fatal consequences

(Sampson, 2005). Many foods are known to elicit food allergy; among those, eight types – i.e. peanuts, nuts, wheat, soy, milk, egg, fish and shellfish – are reported to be responsible for causing the majority (>90%) of allergic reactions (Bush & Hefle, 1996). In Thailand, food allergy is still unfamiliar, and only limited information has been reported. One emergency department in a Thai university hospital reported the most common causes of anaphylaxis to be foods, mostly seafood, followed by milk and wheat

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(Poachanukoon & Paopairochanakorn, 2006). Another study of adverse food reactions including food allergy in 656 Thai children revealed that milk and egg were the two foods most commonly reported to cause adverse reactions in young children; whereas seafood, particularly shrimp, was the most common allergen for older children (Santadusit, Atthapaisalsarudee, & Vichyanond, 2005). These studies suggested that the existence of food allergy in Thailand is similar to other countries, although the majority of Thai people are still not aware of food allergy.

Currently, the most effective way of preventing allergic reactions is the strict avoidance of the offending allergic food, due to the fact that there is no known medication for food allergy (Vierk, Koehler, Fein, & Street, 2007). In order to ensure avoidance of the offending food allergen, a labeling system to provide information regarding food allergens used in food products has been adopted globally (Mills et al., 2004; Yamakawa et al., 2007). Thailand, however, has not participated in this program. Regardless of labeling, complete avoidance is still difficult, because food products may not be properly labeled or may contain a food allergen by mistake – e.g. an ingredient derived from a food allergen may be overlooked (De Luis, Lavilla, Sanchez, Calvo, & Perez, 2008). Also, unintentional inclusion of food allergens might arise from cross-contamination in the food production process (Holzhauser & Vieths, 1999). Undeclared food allergens in food products pose a major risk for allergic individuals; hospital emergency departments have reported that severe allergic reactions have been caused by the accidental intake of food containing allergenic materials (Wüthrich & Ballmer-Weber, 2001). At present, the scientific study of undeclared allergens in commercial Thai food products is lacking. Surveys are urgently required in order to assess the health hazards from food allergy, as well as to ensure the safety of commercial food products.

Our present work is the first investigation to report undeclared food allergens in commercial food products in Thailand, using a quantitative immunoassay (ELISA) suitable for examining processed foods. Furthermore, any products testing positive for milk or egg allergens by ELISA assay were further confirmed for the presence of specific milk or egg protein by Western blot (WB) test.

2. Materials and methods

2.1. Materials

Quantitative ELISA test kits for determining egg, milk, wheat and peanut – as well as qualitative WB test kits for determining specific egg and milk proteins (ovalbumin and casein, respectively) – were provided by Morinaga Institute of Biological Science, Inc., Yokohama, Japan. The limit of quantification (LOQ) of the ELISA kit was 0.3 µg allergen protein/g food (0.3 ppm), and the limit of detection of WB kit was 0.5 ppm.

One hundred and forty-two commercial Thai food products were collected during June to September 2008 from local food stores, supermarkets, and the exhibition of Thai foods for export (“THAIFEX 2008”) held in Bangkok, Thailand. The product name and its ingredients declared on the label were recorded.

2.2. Methods

2.2.1. Quantitative ELISA test

2.2.1.1. Sample preparation. The forms of the surveyed food products were diversified, from liquids to solids, including powders, cakes and pastes. These food products were sometimes not homogenous in the serving package; in that case the test sample for the assay was prepared from whole one serving, or by collecting samples from different parts of the package to represent the

product of interest. Each product was mixed thoroughly, and then ground and homogenized to a fine powder or homogenous mixture. Sample preparation was performed with clean instruments, and the prepared samples were kept in clean containers to avoid cross-contamination.

2.2.1.2. Allergen determination by ELISA. Each homogenous sample was treated and the allergen content determined according to the ELISA kit instructions. An observed ELISA result with an allergen content equal to or greater than 10 ppm (10 µg per 1 g food product) was classified as “positive,” since this low level of food allergen is considered to be the threshold value for eliciting allergic reactions (Bindsløv-Jensen, Briggs, & Osterballe, 2002). Additionally, the Japanese government has established 10 ppm as the level for mandatory labeling of food allergens.

2.2.2. Confirmatory examination of the specific allergen protein by WB test

WB examination for specific milk (casein) or egg (ovalbumin) proteins was performed on all food products having a positive ELISA result for milk or egg allergen. WB procedure was carried out according to the manufacturers’ instructions. In brief, the sample extract (a standard allergen protein, casein or ovalbumin), Kaleidoscope Prestained Standards, and a molecular weight marker (Bio-Rad Laboratories, Inc., USA) were applied to SDS-gel electrophoresis (Laemmli, 1970), after which the SDS gel was blotted onto a PVDF membrane (Amersham Hybond-P, GE Healthcare, UK) by Trans-Blot semi-dry electrophoretic transfer cell (Bio-Rad Laboratories). During immunostaining, rabbit antibodies against casein or ovalbumin protein supplied in the WB kit reacted with the blotted membrane; the membrane was then treated using a VECTASTAIN ABC-AP Rabbit IgG kit (Vector Laboratories, USA), and finally a BCIP/NBT Alkaline Phosphatase Substrate Kit IV (Vector Laboratories). The immunostained band appearing at the respective molecular mass location (casein 33–35 kDa, ovalbumin 50 kDa) was interpreted as a “positive” result.

3. Results

One hundred and forty-two commercial pre-packaged Thai food products, collected locally, were categorized into 25 product types based on their characteristics and use. The most abundant group was instant noodles, either from wheat or rice (14.8%), followed by sauces (10.6%), snacks (9.9%), rice flour products such as dry rice noodles/rice paper/rice flakes (8.5%), meat balls (fish, shrimp, cuttlefish and pork) (7.7%), salad dressing (7.7%), curry powder/spices (7.0%), coconut milk/coconut cream/cereal cream (6.3%), imitation crab stick/imitation salmon stick (4.2%), instant rice porridge (3.5%), and others (Table 1).

Quantitative ELISA results for undeclared food allergens in commercial food products are presented in Fig. 1. Foods with an allergen declared on the label were omitted from ELISA testing, and were classified as “not tested” (NT). Most of the food products examined by ELISA were determined to have an allergen content less than the LOQ (0.3 ppm), shown as “ND” (not detected). The egg ND group was observed in 106 cases in 129 food products; milk in 103 cases in 129 products; wheat in 81 cases in 124 products; and peanut in 139 cases in 141 products. This meant that the labeling was properly done in most of the examined products. On the other hand, there were a significant number of cases containing undeclared food allergen greater than 1%, namely wheat (5 cases), egg (3 cases) and milk (3 cases).

Out of 142 commercial food products, a total of 55 positive cases of undeclared food allergens were observed. The frequency of undeclared milk-positive cases was 21, followed by wheat- and

Table 1

Pre-packaged food products collected in Thailand (142 samples).

Food product	Number
Instant noodles (wheat, rice)	21
Sauce	15
Snack	14
Rice flour product (dry rice noodles, rice paper, rice flakes)	12
Fish/meat balls (fish, shrimp, cuttlefish and pork)	11
Salad dressing	11
Curry powder/spices	10
Coconut milk/coconut cream/cereal cream	9
Imitation crab stick/imitation salmon stick	6
Instant rice porridge	5
Soup	4
Flour custard mix/agar dessert mix	4
Vermicelli (mung bean)	3
Flour (corn flour)	3
Seasoning mix	2
Garlic spread/tuna spread	2
Cooked rice	2
Breaded surimi	1
Cereal mix	1
Hot dog	1
Monosodium glutamate	1
Fermented shrimp paste	1
Surimi with flour (frozen)	1
Tsumire (fish paste)	1
Vegetarian canned tuna	1

egg-positive cases, both with 17 (Fig. 2). Fortunately, no peanut-positive cases were found among examined food products. (In Western countries, peanut is frequently reported to elicit severe anaphylactic reactions.) Only 2 cases presenting peanut contents less than 10 ppm were observed (Fig. 1).

In our survey, milk was the most common positive allergen found in various kinds of processed food. The ingredients declared on the labels of the products testing positive by milk-ELISA are shown in Table 2. Among 21 milk-positive cases, the product group appearing most frequently was instant noodles (7 cases), followed by curry (5 cases) and salad dressing (3 cases); while the food products found to contain milk greater than 1000 ppm were curry, dessert mix and snacks.

Moreover, 17 egg-positive cases were recorded. The major food group with undeclared egg was found to be fishery products such as fish balls, fried fish cake, chikuwa, fish tofu, tuna spread, vegetarian canned tuna, crab stick and breaded surimi. The highest undeclared egg content was found at a level of 35,250 ppm in vegetarian canned tuna, followed by fish tofu and instant wheat noodles which contained 15,750 and 10,718 ppm egg, respectively (Table 3).

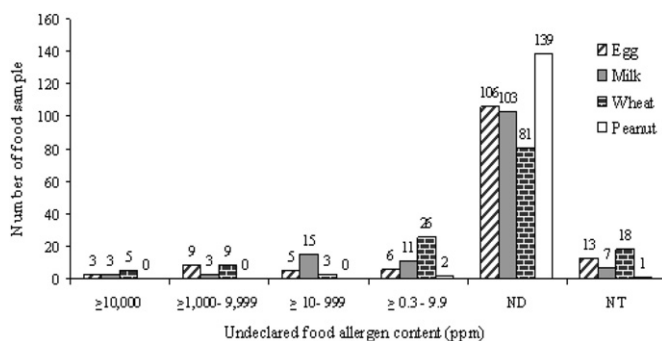


Fig. 1. Distributions of undeclared food allergen content in commercial Thai food products examined by ELISA. ND = not detected (detected food allergen is less than kit LOQ (0.3 ppm)); and NT = not tested (food allergen in question is labeled).



Fig. 2. Positive cases of each food allergen in examined commercial Thai food products (allergen content ≥ 10 ppm).

Besides milk and egg, 17 wheat-positive cases were also detected, as shown in Table 4. Five products contained high undeclared wheat allergen in a range of 14,250–174,000 ppm (equivalent to 1.4–17.4%). The highest level was found in Thai noodles for curry products, and then fish ball products followed by crab stick and imitation crab stick. Wheat presence was hardly recognizable from the labeling of these products (Table 4).

Moreover, we observed that most of the allergen-positive products contained one undeclared food allergen. Only shrimp ball, fish ball with seaweed, cuttlefish ball and crab stick presented two allergens (egg and wheat); and merely one product, vegetarian canned tuna, contained three allergens (egg, milk and wheat).

Food products observed to contain undeclared milk or egg were further examined by Western blot analysis in order to verify the presence of milk-specific protein (casein) and egg-specific protein (ovalbumin). As a result, all 21 milk-positive ELISA products were proved to contain casein, although the ingredient labels did not declare any “milk” (Table 2). Similarly, all 17 egg-positive products tested positive for the presence of ovalbumin, although there was no sign of “egg” on the label (Table 3). Those data verified that ELISA examination is an effective tool for the determination of food allergens in processed food products.

4. Discussion

Presently, the number of food-allergic individuals is reported to have increased in many countries including the Asian region (Shek & Lee, 2006). Several studies in Thailand have also supported the increase of food allergy as well (Jirapinyo, Densupsoontorn, Wongarn, & Thamonsiri, 2007; Ngamphaiboon, Chatchatee, & Thongkaew, 2008; Piromrat, Chinratanaipisit, & Trathong, 2008; Poachanukoon & Paopairochanakorn, 2006; Santadusit et al., 2005), and one reported that the most hazardous reaction, anaphylaxis, was found to be triggered principally by food allergy (Piromrat et al., 2008). This might due to food allergen labeling not being mandatory in Thailand. At present, labeling is totally dependent on the voluntary participation of food manufacturers. From time to time, this has created confusion among consumers: whether a label which does not specify the presence of any food allergen means that the product does not contain any food allergen, or whether the label simply does not mention that the product does contain a food allergen. Furthermore, in the practice of food production, there are cases where a product which contains a food allergen is not labeled as such by mistake; or a product may be inadvertently contaminated with a food allergen during the production process, such as

Table 2

Ingredients of food products testing positive by milk-ELISA, with Western blot test results.

Commercial food product	Ingredients declared on the label	ELISA (ppm) ^a	Western blot (casein)
Instant green curry-2	Coconut cream powder, green curry paste	30,000	Positive
Instant red curry	Coconut cream powder, red curry paste	30,000	Positive
Coconut agar dessert mix	Coconut cream powder, refined sugar, agar powder, salt, coconut flavor, natural flavor	30,000	Positive
Agar dessert mix	Sugar, non-dairy creamer, agar, artificial flavors	2250	Positive
Instant green curry-1	Green chili, garlic, shallot, galangal, lupine, coconut cream powder, sugar, salt	2063	Positive
Japanese rice snack (sour cream flavor)	Japanese rice, corn flour, seasoning, sour cream flavoring, vegetable oil, tapioca flour, sugar, salt	1406	Positive
Green curry powder	Coconut cream powder, chili, garlic, lemongrass, salt, spices, sugar, shallot, galangal, kaffir lime peel, ground pepper, silicon dioxide	188	Positive
Thai green curry	Green curry paste, coconut cream powder, soybean oil, non-dairy cream, palm sugar, chicken soup powder, fish sauce, red chilies, Thai basil leaves, kaffir lime leaves	188	Positive
Salad dressing-3	Soybean milk, sugar, vinegar, whole egg, salt	169	Positive
Instant rice porridge	Dehydrated rice, white sugar, salt, soy sauce powder, dehydrated egg, dehydrated shrimp, dehydrated seaweed, sesame oil, spices, dehydrated spring onion, nicotinamide, vitamin B6, vitamin B1	131	Positive
Japanese rice snack (corn with cheese flavor)	Japanese rice, seasoning, corn with cheese flavor, vegetable oil, artificial flavors	125	Positive
Instant rice vermicelli-2	Rice flour, sugar, salt, tapioca starch, palm oil, parsley, non-dairy cream, monosodium glutamate, disodium 5'-ribonucleotide, natural color, artificial flavor	122	Positive
Instant rice vermicelli-3	Rice flour, sugar, salt, tapioca starch, palm oil, parsley, non-dairy cream, monosodium glutamate, disodium 5'-ribonucleotide, natural color, artificial flavor	122	Positive
Instant rice noodles-1	Rice flour, sugar, salt, tapioca starch, palm oil, parsley, non-dairy cream, monosodium glutamate, disodium 5'-ribonucleotide, natural color, artificial flavor	122	Positive
Instant rice noodles-2	Rice flour, sugar, salt, tapioca starch, palm oil, parsley, non-dairy cream, monosodium glutamate, disodium 5'-ribonucleotides, natural color, artificial flavor	122	Positive
Instant rice vermicelli-1	Rice flour, sugar, salt, tapioca starch, palm oil, parsley, non-dairy cream, monosodium glutamate, disodium 5'-ribonucleotide, natural color, artificial flavor	117	Positive
Instant rice noodles-2	Rice flour, sugar, salt, tapioca starch, palm oil, parsley, non-dairy cream, monosodium glutamate, disodium 5'-ribonucleotide, natural color, artificial flavor	108	Positive
Instant wheat noodles-2	Wheat flour, palm oil, seasoning (chili powder, lemongrass, bergamot leaf and galangal), cream powder, shallot, monosodium glutamate, artificial flavor, natural color	52	Positive

Table 2 (continued)

Commercial food product	Ingredients declared on the label	ELISA (ppm) ^a	Western blot (casein)
Salad dressing-1	Soybean milk, sugar, vinegar, chicken breast, whole egg, fermented cucumber, salt, fermented carrot	23	Positive
Salad dressing-2	Soybean milk, sugar, salt, vinegar, pepper, butter, whole egg	14	Positive
Vegetarian canned tuna	Vegetables, vegetable protein (soy), sugar, salt, vegetable oil, non-meat flavor	10	Positive

^a Products for which the ELISA result was greater than 10 ppm are listed.

by inadequate cleaning of shared equipment or through the reworking of allergen-containing products (Diebel et al., 1997; Holzhauser & Vieths, 1999).

In this study, allergen analysis was conducted by taking into account “false negatives” as processing effects and “false positives” as cross-reactions (Shoji, 2009). Consequently, an ELISA test kit suitable for examining processed foods was selected to cope with

Table 3

Ingredients of food products testing positive by egg ELISA, with Western blot test results.

Commercial food product	Ingredients declared on the label	ELISA (ppm) ^a	Western blot (ovalbumin)
Instant wheat noodles-2	Wheat flour, palm oil, sugar, refined salt, pork powder, galangal powder, monosodium glutamate, disodium 5'-inosinate, disodium 5'-guanylate	10,718	Positive
Vegetarian canned tuna	Vegetables, vegetable protein (soy), sugar, salt, vegetable oil, non-meat flavor	35,250	Positive
Fish tofu	Fish fillet, water, soybean oil, natural seasoning, salt, monosodium glutamate, glucose	15,750	Positive
Imitation salmon stick	Fish, flour, salt, sugar, DHA, natural flavor and colors	5629	Positive
Artificial crab	Fish, flour, salt, sugar, crab flavor	3750	Positive
Shrimp ball	Fish fillet, seasoning, shrimp meat, water, tapioca starch, sugar, salt	2250	Positive
Fish ball	Sea fish fillet, tapioca starch, sugar, salt	2063	Positive
Seafood fish ball	Fish fillet, seasoning, water, tapioca, salt, sugar	2063	Positive
Cuttlefish ball	Fish fillet, cuttlefish meat, seasoning, water, tapioca starch, salt, sugar	1969	Positive
Fish ball with seaweed	Fish fillet, seasoning, shrimp, cuttlefish meat, water, tapioca starch, salt, sugar	1500	Positive
Fried fish cake	Minced threadfin bream, ginger, water, tapioca starch, sorbitol, monosodium glutamate, calcium carbonate, sugar, salt, artificial food color	1500	Positive
Chikuwa	Fish, flour, seasoning, natural flavoring and colors	1500	Positive
Breaded surimi	Fish, bread bits, wheat, soybean oil, sugar, salt, monosodium glutamate	1125	Positive
Salad cream with seafood	Salad cream, shrimp, cuttlefish, carrot, onion, potato	469	Positive
Tuna spread	Tong gold tuna, mayonnaise, chufa, pickled cucumber, no preservative added	375	Positive
Crab stick	Fish fillet, starch, salt, sugar, crab flavor	61	Positive
Japanese cracker	Japanese rice, seasoning, garlic with cheese flavoring, vegetable oil, artificial flavors	33	Positive

^a Products for which the ELISA result was greater than 10 ppm are listed.

Table 4
Ingredients of food products testing positive by wheat ELISA.

Commercial food products	Ingredients declared on the label	ELISA (ppm) ^a
Thai noodles for curry	Flour, salt, water	174,000
Fish ball with seaweed	Fish fillet, seasoning, shrimp, cuttlefish meat, water, tapioca starch, salt, sugar	18,000
Shrimp ball	Fish fillet, seasoning, shrimp meat, water, tapioca starch, sugar, salt	11,630
Cuttlefish ball	Fish fillet, fish meat, seasoning, water, tapioca starch, salt, sugar	14,250
Chicken ball	Chicken, salt, sugar, seasoning, spices, no preservative	14,250
Seafood fish ball	Fish fillet, seasoning, water, tapioca, salt, sugar	7313
Vegetarian canned tuna	Vegetables, vegetable protein (soy), sugar, salt, vegetable oil, non-meat flavor	7125
Crab stick	Fish fillet, starch, salt, sugar, crab flavor	3750
Seaweed rice snack	Rice, corn, vegetable oil, seaweed, soy sauce, seasoning flavor	2625
Imitation crab stick	Fish fillet, egg white, starch, artificial color and flavor	2250
Flour custard mix (vanilla flavor)	Sugar, coconut milk, egg, flour, condensed milk, preservative, artificial flavor and color	2063
Flour custard mix (pandan flavor)	Sugar, coconut milk, egg, flour, condensed milk, preservative, artificial flavor and color	2063
Seaweed rice snack	Rice, corn, vegetable oil, seaweed, seasoning, Teriyaki seasoning flavor	1969
Coconut milk (with reduced saturated fat)	Coconut milk, sunflower oil, rice bran oil, isolated soy protein	1031
Japanese rice snack (corn with cheese flavor)	Japanese rice, seasoning, garlic with cheese flavoring, vegetable oil, artificial flavors	188
Suki sauce	Water, chili, garlic, pickled bean curd, sugar, citric acid, salt, soybean oil, MSG, no artificial coloring	180
Shrimp snack with Thai chili paste	Tapioca flour, fish, palm oil, garlic, sugar, salt, pepper, seasoning	19

^a Products for which the ELISA result was greater than 10 ppm are listed.

“false negatives.” A confirmatory WB test was also conducted to examine “false positives” in milk and egg ELISA assays. Milk-positive ELISA results in vegetarian canned tuna and in instant red and green curries, and egg-positive results in vegetarian canned tuna and fried fish cake, indicated no false negative observations even in those highly heat-processed foods. WB tests to confirm the presence of egg protein or milk protein successfully demonstrated that all egg-positive or milk-positive ELISA products were due to the detection of ovalbumin and casein, respectively, and excluded the possibility of false positive observations.

Based on our results, we speculated that there are two patterns of undeclared food allergen. In one instance, high food allergen content might be due to the intentional incorporation of the allergic ingredient into food products, with the incomplete declaration probably by mistake (Vierk, Falci, Wolyniak, & Klontz, 2002). This could be the case for the 11 food products found to contain undeclared food allergens greater than 10,000 ppm – hardly a level which could occur merely due to cross-contamination. Another instance where a trace of food allergen might be present is due to unintentional inclusion by cross-contamination during the production process (Van Hengel, 2007). We noticed that the labels of milk-positive food products often contained the ingredients “cream,” “coconut cream

powder” or “non-dairy cream.” Commonly, “cream” is defined as the milk part rich in fat, so “cream” is considered to principally contain milk protein; coconut cream powder and non-dairy cream are usually fortified with skim milk or casein to improve their taste and texture, which is why milk proteins can be detected. Moreover, a product which uses the milk fraction or a derivative such as casein can be classified as “non-dairy.” Thus, the milk-allergic individual may frequently misinterpret “non-dairy” as being free from milk. Salad dressings labeled as containing soybean milk were observed to have milk-positive results, because some soybean milk manufacturer commonly add 1–2% whole milk powder to soybean milk for technical purposes (De Luis et al., 2008), as well as for providing favorable taste and nutritional values.

As shown in Table 3, many fishery products were found to contain egg allergen. Generally such fishery products extensively utilize egg white as an ingredient to improve the texture due to the emulsification, forming and gelation properties of egg white (Wang & Wang, 2009). “Salad cream with seafood” presented a positive result by egg ELISA because of the detection of ovalbumin in egg white, although salad cream is known to be made of egg yolk. WB testing confirmed the presence of ovalbumin, probably because egg yolk used in food manufacturing may contain egg white as an impurity.

Research on food allergy has determined that milk and egg allergies appear to be the most prevalent in children (Hill et al., 1997), and are now common among Thai children (Santadusit et al., 2005). Our findings indicate that special care should be given to commercial food products for children.

Wheat, like egg, is another frequently undeclared food allergen; it is the most frequent allergen showing undeclared allergen content greater than 10,000 ppm. This high level of undeclared wheat content implies a significant risk, because wheat is also known to frequently elicit an anaphylactic reaction. Thai noodles for curry were observed to have the highest undeclared allergen content, 174,000 ppm, which the ingredient label described as “flour, water and salt.” Thai consumers may believe that Thai noodles are traditional rice noodles, because rice has been the primary crop since ancient times; hence “flour” on the label is interpreted as “rice flour” instead of “wheat flour.” This confusion in wording may be somewhat specific to Thailand; but it exemplifies the misunderstanding that may arise from the same wording being interpreted differently among consumers of different cultural backgrounds. Major products containing undeclared wheat in our investigation were fish balls, coconut milk (with reduced saturated fat), flour custard mix, rice snacks, crackers, and vegetarian canned tuna. The inclusion of wheat in these products is due to wheat protein which is widely used to improve the texture of fishery products; and another cause is wheat-derived seasoning, wheat hydrolysate, which is added to enrich the taste. Another speculated cause is “starch,” which is also a popular ingredient in a wide variety of food products. This starch is often sourced from wheat, and contains wheat protein as an impurity; thus the use of wheat starch often gives a positive result in an ELISA assay.

In order to eliminate the above obscure or misleading labeling information, labeling standardization – providing accurate product information for food-allergic individuals – is indicated, such as stating the ingredients with common names like “milk,” “egg” or “wheat,” as well as labeling the origin of the food additive (e.g. “derived from milk”).

The successful detection of food allergens in commercial food products indicated the potential for better food allergen management by food manufacturers through monitoring of finished products by a fast and easy ELISA test (Poms, Klein, & Anklam, 2004) before releasing the products into the marketplace.

5. Conclusions

Our work is the first evidence-based report to assess the risk of commercial food products sold in Thailand with respect to food allergens. ELISA and WB assays of various Thai commercial food products demonstrated that most of them were properly labeled for food allergens, although some contained undeclared food allergens. The major food allergens found were milk, egg, and wheat. Such undeclared food allergen contents were observed high enough to potentially elicit an allergic reaction in susceptible consumers.

Our findings should serve as a warning to food manufacturers to consider improved food allergen management during food production, particularly from the standpoint of product liability. Additionally, in the absence of food allergen labeling legislation in Thailand, food manufacturers are strongly urged to provide allergen information voluntarily through product labeling in order to avoid the hazards from food allergy.

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