

A Population-Based Study of Fish Allergy in the Philippines, Singapore and Thailand

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Key Words

Fish allergy · Food allergy · South East Asia

Abstract

Background: Fish allergy is the third most common food allergy after milk and egg in parts of Europe, but there is little data about prevalence in South East Asia where it is an important part of regular diets. **Objective:** We aimed to obtain an estimate of the population prevalence of fish allergy among older children in the Philippines, Singapore and Thailand. **Methods:** The population prevalence of fish allergy in 14- to 16-year-old children in the 3 countries was evaluated using a structured written questionnaire which was distributed to students of randomly selected secondary schools. An extended questionnaire to determine convincing fish allergy on the basis of typical clinical manifestations within 2 h of ingestion was administered to those with positive responses. **Results:** From a cohort of 25,842 students, responses were 81.1% in the Philippines (n = 11,434), 67.9% in Singapore (n = 6,498) and 80.2% (n = 2,034) in Thailand. Using criteria for convincing food allergy, fish allergy was much higher in the Philippines [2.29%, 95% confidence interval (CI) 2.02–2.56] than in Singapore (0.26%, 95% CI 0.14–0.79) and Thailand (0.29%, 95% CI 0.06–0.52). Weighted multiple logis-

tic regression analyses showed that compared to the Philippines, prevalence rates were lower in Singapore [odds ratio (OR) 0.40, 95% CI 0.27–0.60, p < 0.0001] and Thailand (OR 0.13, 95% CI 0.05–0.33, p < 0.0001). Females were more likely to have fish allergy compared to males for all children combined (OR 1.32, 95% CI 1.11–1.58, p = 0.002). Most allergies appeared mild, as only 28% of cases sought medical consultation at the time of the reaction and 31.2% of cases reported continued exposure despite allergic symptoms. **Conclusion:** Fish allergy in late childhood is more common in the Philippines compared to Singapore and Thailand. Differences in food processing, dietary habits and other cultural practices might be important risk factors for the development of fish allergy in these populations.

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Introduction

Whilst fish is an important component of the diet of many communities, fish proteins are also well-recognized food allergens. Most cases of fish allergy are IgE-mediated occurring after contact [1], inhalation [2] or, more commonly, ingestion [3]. Less common fish-related causes of allergy symptoms include non-IgE-mediated

food-protein-induced enterocolitis syndrome, scombroid poisoning from ingesting large amounts of biogenic amines in inadequately preserved fish and gastroallergic anisakiasis, a gut parasitic infection that can occur after eating raw fish. Descriptions of the occurrence of fish allergy are mostly from Scandinavian countries, Spain and Portugal where fish is the third most common allergen after milk and egg in infancy and is an important part of the local diet. Fish allergy has been reported in 17.8% of allergic reactions referred to secondary-care clinics in Spain and 4.8% in North America [4]. The population prevalence in North America has been reported at 0.4% [5]. The pattern of onset of fish allergy in European countries is typically around 6 months to a year when fish is first introduced into the diet. Allergic symptoms typically include urticaria, angioedema, oral symptoms, worsening eczema, online suppl. fig. 1, 2, see www.karger.com/doi/10.1159/000338940 and respiratory and gastrointestinal effects [6].

There is little data about the occurrence of fish allergy in Asian countries, although a recent survey in Hong Kong of preschool children aged 2–7 years documented a parent-reported prevalence of 0.32% [7]. In this study, shellfish was the most common cause of allergic symptoms with a prevalence of 1.32% which is similar to the prevalence of 1.19% that we have previously reported amongst 4- to 6-year-old Singaporean children [8]. In this paper we report further data to compare the occurrence of fish allergy among school children in the Philippines, Singapore and Thailand using a structured questionnaire with established criteria for convincing allergy [9].

Methods

This paper reports the results of a cross-sectional study about the occurrence of fish allergy involving 14- to 16-year-old age-matched children in Metro Manila in the Philippines, in Singapore and in Bangkok, Thailand (August 2007–February 2008). This study was part of a larger cross-sectional study of food allergy in these 3 populations which also included allergies to peanut, tree nuts and shellfish. Data concerning the other food allergies has been reported elsewhere [8]. Schools included in the study were randomly selected from a list of secondary schools in all 3 countries. The study was approved by the National University of Singapore Ethics Committee and the Ministry of Education in Singapore, the Research Ethics Committee, Faculty of Medicine, Chulalongkorn University in Bangkok, Thailand and the Department of Education in the Philippines. The survey was conducted in 2 parts and used a structured questionnaire (fig. 1, online suppl. fig. 1, 2, see www.karger.com/doi/10.1159/000338940) previously used by Sicherer et al. [9] in the USA, which was accurate for the detection of type 1 allergic reactions. The first part collected demographic data, the presence of physician-diagnosed asthma, eczema and rhinitis and the occurrence of specific food allergies including fish allergy. All respondents reporting the occurrence of food allergies completed the second part of the questionnaire. This part of the survey asked more detailed questions about the specific allergic symptoms and their timing to determine whether convincing reactions had occurred. As used by other researchers, the reporting of allergic reactions was considered convincing if typical allergic symptoms (i.e. any of hives, angioedema, trouble breathing, wheezing, throat tightness, vomiting and diarrhoea) had commenced within 2 h of ingestion [5]. Students completed the first part of the survey themselves and were assisted by their parents with the second part. The questionnaire was provided in Chinese, Malay, Tagalog and Thai languages for parents who were not literate in English. All data were double-entered and cross-checked for accuracy.

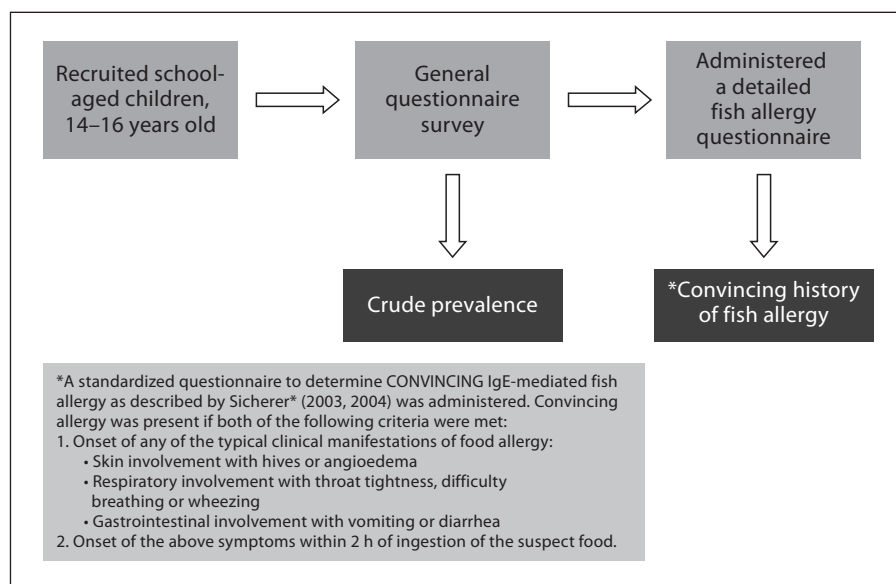


Fig. 1. Flow chart.

Statistical Analysis

SUDAAN V10.0.1 (Research Triangle Institute, Research Triangle Park, N.C., USA) was used for statistical analyses. Weighted prevalence rates, 95% confidence intervals (CIs) and comparison between age groups and populations were calculated to account for the cluster-sampling survey design and to adjust for selection probability and nonresponses. Weights were calculated based on the selection probability of schools in the 3 regions and the response probabilities (estimated using response rate at school level). A sampling design without replacement was chosen for estimation of prevalence. To study associated risk factors for fish allergy, weighted multiple logistic regression models were applied with adjustment for potential confounding factors, i.e. gender, ethnic group, country of birth and comorbid asthma, allergic rhinitis and eczema. To test whether there was a significant association between fish allergy and allergy to other foods, χ^2 tests were used. Fisher's exact test was used to assess the significance of differences in the prevalence of allergy, age of exposure and age of onset of allergy between groups. A p value of <0.05 was considered significant for all analyses.

Results

Of 25,842 surveys sent to children aged 14–16 years, 19,966 were returned [Philippines 11,434 (81.1%), Singapore 6,498 (67.9%) and Thailand 2,304 (80.2%)]. Data returned from a small number of expatriate schools in Singapore were not included. The demographic data for children whose surveys were returned is shown in table 1. Table 2 shows the results for reported and convincing fish allergy. There was a highly significant difference in the reported prevalence of fish allergy between the Philippines and the other two countries ($p < 0.0001$) and a nearly 3:1 ratio of females versus males. The symptoms described were typical for IgE-mediated allergy (table 3).

The presence of coexisting allergic illness was relatively low, with 61 (23%) of the Filipino, 3 (18%) of the Singa-

porean and 3 (50%) of the Thai children reporting asthma, 56 (21%), 4 (23%) and 4 (66%), respectively, reporting allergic rhinitis and 72 (27%), 3 (18%) and 3 (50%), respectively, reporting eczema.

The effects of demographic factors such as sex, country and presence of comorbid atopic disorders on the occurrence of fish allergy were determined using weighted multiple logistic regression. Comparing the country of origin using Philippines as the reference group, there was a significantly lower odds ratio (OR) for living in Singapore and Thailand. Female sex and having either allergic rhinitis, asthma or eczema were also significant risk factors (table 4).

Table 1. Demographic features of schoolchildren surveyed (n = 19,996)

	Philippines	Singapore	Thailand
Number	11,434	6,498	2,034
Sex Distribution			
Male/female, %	42/58	50/50	50/50
Ethnicity (%)			
Chinese	147 (1.3)	5,061 (77.9)	0
Malay	0	884 (13.6)	78 (3.8)
Indians	0	374 (5.7)	0
Eurasian	16 (0.01)	19 (0.3)	0
Filipino	10,534 (92.1)	0	0
Thai	0	0	1,928 (94.8)
Others	91 (0.8)	149 (2.3)	14 (0.7)
Not given	646 (5.6)	11 (0.2)	28 (1.4)
Comorbidities (%)			
Asthma	1,567 (13.7)	1,231 (18.9)	107 (5.3)
Allergic rhinitis	1,330 (11.6)	853 (13.1)	283 (13.9)
Eczema	986 (8.6)	351 (5.4)	77 (3.8)

Table 2. Prevalence of fish allergy

	Philippines (n = 13,989)			Singapore (n = 9,570)			Thailand (n = 2,536)		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Response	11,434	81.1		6,498	67.9		2,034	80.2	
Crude prevalence	439	3.84	3.49–4.19*	39	0.60	0.41–0.79*	8	0.39	0.12–0.66*
Convincing history	262	2.29	2.02–2.56*	17	0.26	0.14–0.79*	6	0.29	0.06–0.52*
Gender									
Male	73/262	27.9		8/17	47.1		4/6	66.7	
Female	189/262	72.1		9/17	52.9		2/6	33.3	

* $p < 0.0001$ Philippines vs. Singapore and/or Thailand.

We used χ^2 tests to determine whether there was a significant association between the reporting of allergy to fish and other foods (shellfish, peanuts and tree nuts). Results were highly significant for the coexistence of fish and shellfish allergy (79/246 fish allergy cases for all

countries combined, $p < 0.0005$) and the coexistence of allergy to fish and 2 or more other food types (17/246 fish allergy cases for all countries combined, $p < 0.0005$).

In 171 (65%) Filipino, 7 (41%) Singaporean and 4 (67%) Thai children, it was reported that allergic symptoms to

Table 3. Occurrence of symptoms of convincing fish allergy

Symptom	Philippines (n = 262) (%)	Singapore (n = 17) (%)	Thailand (n = 6) (%)
Hives	217 (83)	8 (47)	3 (50)
Throat itchiness	98 (37)	6 (35)	0
Lips swelling	73 (28)	6 (35)	2 (33)
Coughing	43 (16)	2 (12)	0
Throat tightness	43 (16)	1 (6)	0
Abdominal pain	40 (15)	0	0
Vomiting	28 (11)	3 (18)	3 (50)
Wheezing	28 (11)	1 (6)	0
Dizziness	22 (8)	0	0
LOC	21 (8)	1 (6)	0
Nasal congestion	20 (8)	1 (6)	2 (33)
Eyes swelling	19 (7)	2 (12)	2 (33)
Diarrhoea	19 (7)	0	0

LOC = Loss of consciousness.

Table 4. Weighted multiple logistic regression analysis of demographic factors associated with fish allergy (n = 19,996)

Risk factor	Convincing fish allergy, n (%)	OR (95% CI)	Adjusted p value
Country			
Philippines	262 (2.29)	1.00	–
Thailand	6 (0.29)	0.13 (0.05–0.33)	0.0005
Singapore	17 (0.26)	0.40 (0.27–0.60)	0.0005
Sex			
Male	85 (0.96)	1.00	–
Female	200 (1.86)	1.32 (1.11–1.58)	0.002
Comorbidities			
Asthma	65 (2.26)	1.35 (1.02–1.79)	0.035
Allergic rhinitis	60 (2.47)	1.70 (1.30–2.23)	0.0005
Eczema	75 (5.41)	3.36 (2.74–4.11)	0.0005

Table 5. Prevalence of fish allergy in different countries

Country	Age, years	Study subject	Sample size, n	Self-reported %	Self-reported and IgE sensitization, %	Oral-graded food challenge, %	Reference
USA	0–17 18–61 all ages	population-based	3,607 9,816 14,948	0.17 0.48 0.39			Sicherer et al. [5]
Canada	children adult all ages	population-based	9,667	0.18 0.56 0.48	0 0.12 0.10		Ben-Shoshan et al. [26]
Denmark	0.1–22 22–60 all ages	birth cohort plus relatives	936 898 1,834		0.52 0.67 0.60	0 0.22 0.11	Osterballe et al. [27]
France	2–14	population-based	2,716	0.70			Rance et al. [28]
Norway	0–2	birth cohort	2,803	3.0			Eggesbo et al. [29]
Sweden	0–4	birth cohort	2,614		0.69		Kull et al. [15]
Turkey	6–9	population-based	2,739	0.33	0.18	0.04	Orhan et al. [30]
China	<1	population-based	477		0.21		Chen et al. [31]
Hongkong	2–7	population-based	3,677	0.32			Leung et al. [7]
Philippines	14–16	population-based	11,434	2.29			this study
Singapore	14–16	population-based	6,498	0.26			this study
Thailand	14–16	population-based	2,034	0.29			this study

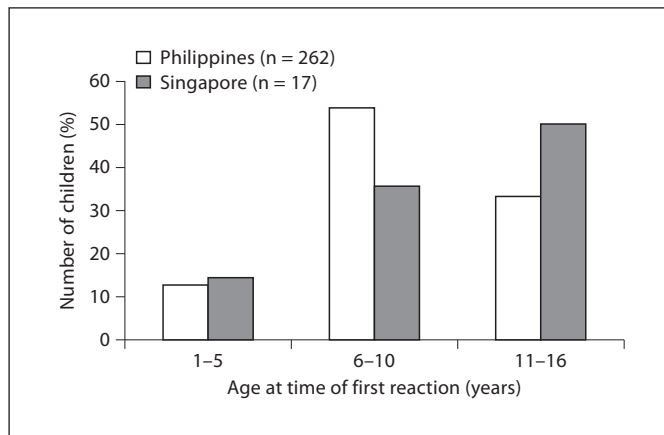


Fig. 2. Age of first reaction to fish.

fish had occurred on first exposure. In all cases reactions were reported to have occurred after the first year of life (fig. 2). Whilst there might have been poor recall of exactly when the implicated fish had first been ingested, it appeared that allergic symptoms occurred for the first time in later childhood in the majority of cases.

The most frequently reported fish causing allergy was anchovy (*dilis*, *ikan bilis*) followed by mackerel scad (*gallunggong*). The types of fish causing most reactions were those mostly commonly eaten as part of a habitual diet and in particular amongst families from lower socioeconomic groups. Of those with fish allergy, 35% (97 out of 279) of children from the Philippines and Singapore reported multiple-fish allergy and 61% (171 out of 279) had allergy to one type of fish (data not available for 11 children). There was no data available on this from the Thai cohort.

Questions were asked about the treatment of episodes and only 74 (28%) Filipino and 4 (23%) Singaporean children and 1 (17%) Thai child had consulted a doctor about their allergic reactions. Despite the history of previous reactions, 83 (32%) children in the Philippines and 5 (29%) in Singapore continued to eat fish and experienced repeat episodes of allergy.

Discussion

Asia has one of the highest rates of fish consumption in the world [10]. The results of this survey are consistent with clinical experience in that, despite a high rate of fish consumption in both countries, fish allergy is uncom-

mon among the Singaporean and Thai population and occurs more commonly in the Philippines. In a previous study of the allergenicity of tropical fish, only 10 Singaporean children with evidence of IgE-mediated allergy to fish were identified over a 2-year period [11]. These children had onset of symptoms in the first year of life, shortly after the introduction of weaning foods, as described in European studies [4]. The rarity of fish allergy in early childhood in Singapore is supported by local data from a similar survey of younger 4- to 6-year-old Singaporean children in which just 11 (male = 5) out of 4,515 families (0.24%, 95% CI 0.1–0.38%) reported convincing allergy (unpubl. data). In this study, we identified a group of children with late-onset fish allergy and which contrasts with the epidemiology of fish allergy reported elsewhere [6]. A review of population and birth cohort studies on the prevalence of fish allergy (table 5) shows that our data from Singapore and Thailand are similar to those reported from Western populations (<1%), with the exception of Norway (3%) which has a similarly high prevalence to the Philippines (2.29%). Relative to shellfish, peanut and tree nut allergy in our populations, the prevalence of fish allergy is as low as peanut and tree nut allergy, with the exception of the Philippines where it is more common and second only to shellfish (table 6) [8].

Although we did not confirm allergy in each case with skin-prick testing and food challenges, the questionnaire used has been shown to be robust in picking up genuine food allergy in other countries [5]. Prevalence data for allergy to other foodstuffs that we have previously reported using this tool have been consistent with similarly conducted Western studies [8]. In the absence of objective allergy testing, it is possible that this survey may have over- rather than underestimated the prevalence of fish allergy in our cohorts. It is also possible that some of the children in the Philippines had scombroid poisoning which can occur after ingesting the types of fish most commonly eaten in this country [12, 13]. However, isolated gastrointestinal symptoms in the absence of any other manifestations were reported only in one subject. Diarrhea was only reported in 7% of cases and abdominal pain in 15%. It is therefore unlikely that many of the children identified had symptoms as a direct result of histamine ingestion.

Allergy symptoms were generally mild with few cases seeking medical attention and a third of cases continuing to eat fish, despite having further allergy episodes. These findings are consistent with our retrospective study of food-induced anaphylaxis of sufficient severity to result in hospital consultation [14]. In this study, fish ingestion

Table 6. Prevalence of food allergy in school-aged children in the Philippines, Singapore and Thailand

	Philippines			Singapore			Thailand		
	n/total	%	95% CI	n/total	%	95% CI	n/total	%	95% CI
Fish allergy									
Crude prevalence	439/11,434	3.84	3.49–4.19	39/6,498	0.60	0.41–0.79	8/2,034	0.39	0.12–0.66
Convincing history	262/11,434	2.29	2.02–2.56	17/6,498	0.26	0.14–0.79	6/2,034	0.29	0.06–0.52
Shellfish allergy ¹									
Crude prevalence	968/11,158	8.68	8.17–9.21	733/6,342	11.56	10.79–12.37	not available		
Convincing history	571/11,158	5.12	4.30–6.08	332/6,342	5.23	4.46–6.14	not available		
Peanut allergy ¹									
Crude prevalence	146/11,322	1.29	1.1–1.51	76/6,450	1.18	0.94–1.47	not available		
Convincing history	49/11,322	0.43	0.31–0.60	30/6,450	0.47	0.36–0.59	not available		
Tree nut allergy ¹									
Crude prevalence	80/11,071	0.72	0.58–0.90	52/6,436	0.81	0.62–1.06	not available		
Convincing history	37/11,071	0.33	0.21–0.53	19/6,436	0.30	0.20–0.44	not available		

¹ Data obtained from Shek et al. [8].

was not identified as a cause for any of the hospital admissions in Singapore for food-induced anaphylaxis over a 5-year period. There are studies suggesting that ingestion of fish during early childhood might be of benefit in preventing the subsequent development of allergic illness [15, 16]. This is of interest because the relative severity of asthma in Singapore as measured by hospitalization rates in children aged 0–14 years for acute wheeze is less than in Australia where fish does not figure so prominently as a weaning food [17].

The high prevalence of fish allergy in the Philippines compared to Singapore and Thailand was very striking and is in contrast to the very similar prevalence of allergy to other foods such as peanuts, tree nuts and seafood that we have previously reported [8]. The female predominance is the opposite of that described elsewhere, where males are more often affected amongst a younger age group [18, 19].

Fish is promoted and widely used as an important part of the early weaning diet during infancy in all 3 countries [20, 21]. This is in contrast to reports from some European countries where fish is only introduced later on [22]. Although there are similar feeding practices in each country, there might be subtle differences leading to differences in the occurrence of fish allergy. Fish sauce is widely used as a condiment in the Philippines, but this is also the case in Thailand and so exposure to this food stuff cannot explain the differences seen. Anchovies (dilis), the most common type of fish causing allergy in the Philippines, are prepared by drying and salting (like tuyo) and is cheaply available throughout the country

(<http://www.marketmanila.com/archives/kinilaw-nadilis-a-la-seaman-anchovy-seviche>). It might be that the heat-processing of these fish products enhances the immunogenicity of the fish proteins in a similar way to that which has been described after the roasting of peanuts [23]. Mackerel scad, the second most common cause of fish allergy, is usually fried and is the most abundant fish in the Philippine waters. It is cheaply available and eaten by the Filipino masses as a daily fish meal (ulam). Whilst these fish types are also available in Singapore and Thailand, they are eaten far more irregularly and as part of a more varied diet. The high level of regular exposure to these fish types in the Philippines is probably related to the increased prevalence of allergy to these foodstuffs.

Thirty-five percent of the children in the survey reported multiple-fish allergy. This was probably due to cross-reactive allergens between fish species. This phenomenon has been well described for tropomyosin, the major allergen in shellfish that shares homology to invertebrate tropomyosins in insect species such as cockroaches, nematodes and dust mites [24]. Parvalbumin, which is the major fish allergen, has also been reported to be cross-reactive across species including mackerel scad and anchovies [11, 25]. It is of interest to note that mackerel parvalbumin is amongst the least allergenic of fish parvalbumins and this may in part explain the mild nature and late onset of fish allergy in our Filipino cohort [25]. Non-cross-reactive allergenic epitopes have also been described between different species of fish including fish consumed in the tropics [11]. This may account for those who report monoallergy to a single fish species, although

abstinence from all fish following an initial reaction might also account for reported allergy to a single species. The significant association of allergy to fish and shellfish is probably related to common exposure in atopic individuals rather than to cross-reactivity.

In summary, we have identified a high incidence of 'late'-onset fish allergy in the Philippines compared to Singapore and Thailand. In contrast to those children developing fish allergy during infancy, the majority of incidences are mild in severity. Further studies are needed to

confirm an IgE mechanism, and then possibly to identify important differences in food processing, dietary habits and other cultural differences to explain these findings.

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Annex A

STUDENT INFORMATION SHEET

Dear student,

We seek your help to have this short survey completed. We are inviting secondary 3 students in Singapore to answer questions about **peanut, nut and seafood allergies**, with the approval of the Ministry of Education. **The information you provide will be treated confidentially.** It will help medical authorities understand allergic diseases better and formulate management strategies for our Singapore schoolchildren. Hence, your participation will be greatly appreciated. Simply return the completed form to the teacher in-charge.

Thank you very much for your kind co-operation.

Yours sincerely,

Dr Lynette Shek
Department of Paediatrics
National University of Singapore

STUDENT'S PARTICULARS

Race: Chinese/Malay/Indian/Others: _____ **Sex:** M / F

Date of birth: _____ (dd/mm/yy)

School: _____ **Class:** _____

Nationality: ☐ Singapore ☐ Others, please specify: _____

Type of Housing: ☐ HDB flat ☐ Private Apartments ☐ Landed

Were you born in Singapore?

☐ No. Please state the country where you were born: _____
And the number of years you have been living in Singapore: _____

☐ Yes. Have you spent more than 1 year in another country? ☐ Yes ☐ No ☐ Not Sure

If yes, how were you when you spent the 1 year outside of Singapore?

☐ < 2 years old ☐ 2 to 5 years old ☐ ≥ 5 years old

Please state the country and the period that you were there: _____

SURVEY QUESTIONS

1. Has your doctor ever told you that you have any of the following?

- Asthma Yes ☐ No ☐ Don't know ☐
- Allergic rhinitis or Sensitive nose or Hay fever Yes ☐ No ☐ Don't know ☐
- Anaphylaxis Yes ☐ No ☐ Don't know ☐
(very severe allergic reaction in which the throat swells up and closes the airway, or the child may lose consciousness)
- Eczema/ Atopic dermatitis Yes ☐ No ☐ Don't know ☐
- Hives/Urticaria Yes ☐ No ☐ Don't know ☐

2. Have you ever had peanut allergy?

☐ Yes ☐ No ☐ Never eaten ☐ Not sure, please explain_____

3. Have you ever had allergy to nuts other than peanuts?

☐ Yes ☐ No ☐ Never eaten ☐ Not sure, please explain_____

4. Have you ever had allergy to fish?

☐ Yes ☐ No ☐ Never eaten ☐ Not sure, please explain_____

5. Have you ever had allergy to shellfish (e.g. prawn, crab, lobster, squid, scallops, clams, oysters, mussels, crayfish)?

☐ Yes ☐ No ☐ Never eaten ☐ Not sure, please explain_____

6. Other Food Allergy,

☐ Yes please specify type of food:_____

☐ No ☐ Don't know

Thank you for taking the time to complete this questionnaire.
The information you have provided is confidential

Annex B

PARENT INFORMATION SHEET

Dear parent/guardian,

We seek your help to have this short survey completed. We are inviting Secondary 3 students in Singapore to answer questions about **peanut, nut and seafood allergies**, with the approval of the Ministry of Education. Your child has indicated that he/she has at least one of the allergies listed above. We ask that you help your child complete this simple questionnaire. **The information you provide will be treated confidentially.** It will help medical authorities understand allergic diseases better and formulate management strategies for our Singapore schoolchildren. Hence, your participation will be greatly appreciated. Simply return the completed form to us using the pre-paid envelopes.

In case you require any medical advice with regards to your child's food allergy, kindly call our hotline 91380032 during office hours.

Thank you very much for your kind co-operation, it is greatly appreciated.

Yours sincerely,

Dr Lynette Shek
Department of Paediatrics
National University of Singapore

I, _____ (name of parent/guardian), consent to let my child
_____ (name of child) of class _____, of
_____ (school) to participate in this survey. I understand that
the information which I provide will be confidential.

Signature of parent/guardian: _____ / _____ (Date)

Address: _____

Contact number: _____ (home) _____ (office) _____ (hp)

FISH ALLERGY

*If you have ever had **fish allergy**, please answer the following questions.*

1. Which fish are you allergic to? (can tick more than 1)	Cod ☐ Tuna ☐ Salmon ☐ Threadfin / Ikan Kurau ☐ Anchovy / Ikan Bilis ☐ Pomfret ☐ Tengirri ☐ White bait fish ☐ Not sure which fish ☐
Others, pls specify: _____	
1a. If you are allergic to more than one fish, indicate which fish gave the most severe reaction (leave blank if not sure). Name of Fish: _____	
QUESTIONS 2 to 13 DEAL WITH YOUR MOST SEVERE REACTION TO FISH	
2. About how old were you when you first ate this fish?	_____ years old
2a. If you are not sure, can you give us an estimate?	< 1 year old ☐ 1 – 5 years old ☐ 6 – 10 years old ☐ 11 – 16 years old ☐ Don't know ☐ Never eaten ☐
3. Did you have an allergic reaction to this fish the FIRST time you ate it?	
Yes ☐ No ☐ Not sure ☐	
IF YOU ANSWERED “FOUND OUT BY ALLERGY TEST”, PLEASE SKIP TO QUESTION 9	
Found out by allergy test, no first reaction ☐	
4. How old were you when you FIRST had a reaction to this fish?	_____ years old
4a. If you are not sure, can you give us an estimate?	< 1 year old ☐ 1 – 5 years old ☐ 6 – 10 years old ☐ 11 – 16 years old ☐ Don't know ☐

5. During the <u>MOST SEVERE</u> allergic reaction to the fish, did you have the following symptoms?			
• Hives (urticaria, itchy rash like mosquito bites)	Yes ☐	No ☐	Don't know ☐
• Swelling of eyes (eyelids)	Yes ☐	No ☐	Don't know ☐
• Swelling of lips or face	Yes ☐	No ☐	Don't know ☐
• Vomiting	Yes ☐	No ☐	Don't know ☐
• Diarrhoea	Yes ☐	No ☐	Don't know ☐
• Abdominal pain	Yes ☐	No ☐	Don't know ☐
• Congested or running nose	Yes ☐	No ☐	Don't know ☐
• Itchy throat or mouth	Yes ☐	No ☐	Don't know ☐
• Throat tightness or choking	Yes ☐	No ☐	Don't know ☐
• Coughing	Yes ☐	No ☐	Don't know ☐
• Wheezing or trouble breathing	Yes ☐	No ☐	Don't know ☐
• Faint or dizzy	Yes ☐	No ☐	Don't know ☐
• Loss of consciousness	Yes ☐	No ☐	Don't know ☐
• Redness of skin	Yes ☐	No ☐	Don't know ☐
• Other symptoms, please specify _____			
6. During this <u>MOST SEVERE</u> episode, after you ate this fish, about how long did it take for the allergic reaction to occur? In less than 10 minutes ☐ In 10 minutes to 1 hour ☐ In 1 to 2 hours ☐ In 2 to 12 hours ☐ After more than 12 hours ☐ Don't know ☐			
7. Did you need/use any of the following in that <u>MOST SEVERE</u> reaction?			
• Treatment at emergency department or hospitalisation	Yes ☐	No ☐	Don't know ☐
• Antihistamine (e.g. Piriton, Benadryl, Atarax, Zyrtec, etc)	Yes ☐	No ☐	Don't know ☐
• Epinephrine/ Adrenaline (Epipen)	Yes ☐	No ☐	Don't know ☐
• Steroids/ Prednisolone	Yes ☐	No ☐	Don't know ☐
• Asthma medicines (e.g. inhalers)	Yes ☐	No ☐	Don't know ☐
8. Have you had an allergy test to confirm the allergy to this fish?			
			Yes ☐
			No ☐
			Don't know ☐
9. Have you ever seen a doctor for your allergy to this fish?			
			Yes ☐
			No ☐
IF YOU ANSWERED "NO" or "DON'T KNOW" PLEASE SKIP TO QUESTION 13			Don't know ☐
10. Has a doctor ever prescribed injectable epinephrine (Epipen) for you?			
			Yes ☐
			No ☐
IF YOU ANSWERED "NO" or "DON'T KNOW" PLEASE SKIP TO QUESTION 13			Don't know ☐
11. Do you have injectable epinephrine with you at all times?			
			Yes ☐
			No ☐
IF YOU ANSWERED "NO" or "DON'T KNOW" PLEASE SKIP TO QUESTION 13			Don't know ☐

12. Why do you NOT carry injectable epinephrine with you at all times?	Not necessary ☐ Avoid the fish anyway ☐ Never been prescribed ☐ Not available ☐ Others, pls specify: ☐
13. Are you now able to eat this fish without any reactions?	Still have reactions ☐ Eat now with no reaction ☐ Haven't eaten again ☐ Only react sometimes ☐ Don't know ☐

IF YOU WOULD LIKE TO CONTACT US FOR FURTHER INFORMATION ON YOUR ALLERGY, PLEASE CALL
MS SITI DAHLIA AT **67724450**.
OTHERWISE, YOU HAVE REACHED THE END OF THE QUESTIONNAIRE.

Thank you for taking the time to complete this questionnaire.
The information you have provided is confidential.