

# Prevalence of self-reported food allergy in Hong Kong children and teens –a population survey

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## Summary

**Background:** There is a paucity of data on the prevalence, natural history and management of food allergy in most of the populous Asian countries, including China

**Objective:** To determine the point prevalence of self-reported food allergy in Chinese children and teenagers in Hong Kong.

**Methods:** A cross-sectional population-based questionnaire survey targeted at children aged 0-14y was conducted by use of face-to-face interviews and self-administered questionnaires. Information was obtained from the parent as proxy respondent for children aged 10 and below and from both parent and child for children aged 11 to 14. Households were drawn from the Register of Quarters maintained by the Census and Statistics Department by systematic replicated sampling.

**Results:** A total of 7,393 land-based non-institutionalized children aged 14 and below in Hong Kong were recruited, excluding those with non-Cantonese speaking parents and those living in non-built-up areas. The sample was representative of the 884,300 children in the target population. 352 reported having adverse reactions to foods and the estimated prevalence was 4.8% (95% CI 4.3-5.3%). The estimated prevalence of peanut allergy was 0.3-0.5% (95%CI 0.1 to 0.7%). In terms of relative frequency, shellfish, which was the top allergen,

accounted for more than a third of all reactions. The second most common was hen's egg (14.5%), the third cow's milk and dairy products (10.8%) and co-fourth were peanut and combined fruits (8.5%). Out of 352 subjects who reported adverse reactions, 127 (36.1%) had urticaria and or angioedema and 79 (22.4%) had eczema exacerbations. Combined gastrointestinal symptoms accounted for 20.8 % (diarrhoea 12.8%; vomiting 5.4%; abdominal pain 2.6%). Fifty-five (15.6%) had anaphylaxis, and 7 (2%) had respiratory difficulties.

**Conclusion:** This survey has provided the first population based epidemiological information related to food allergy amongst children and younger teenagers in Hong Kong. The prevalence of food allergy, including that from more common subtypes, like shellfish and peanut, is highly comparable to that of most of the developed nations. (*Asian Pac J Allergy Immunol 2012;30:275-84*)

**Key words:** food allergy, children, population, questionnaire survey, quality of life

## Introduction

Food allergy is an immune-based disease that has become a serious health concern in most of the developed nations. A recent US study<sup>1</sup> estimates that food allergy affects 5% of children under the age of 5 years and 4% of teens and adults, and its prevalence appears to be increasing. The symptoms of this disease can range from mild to severe and, in rare cases, can lead to anaphylaxis, a severe and potentially life-threatening allergic reaction. There are no therapies available to prevent or treat food allergy: the only preventive option is to avoid exposure to the food allergen, and its treatment mainly involves symptomatic measures. Because the most common food allergens—eggs, milk, peanuts, tree nuts, soy, wheat, crustacean shellfish, and fish—are highly prevalent in the diet in different modern cultures, patients and their families must remain constantly vigilant. The recently published Guidelines for the Diagnosis and Management of Food Allergy in the United States met a long-

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Submitted date: 26/3/2012

Accepted date: 2/7/2012



standing need for harmonization of best clinical practices related to food allergy across medical specialties. Similar national guidelines are lacking in Asia, except in Japan. In fact prevalence studies in Asia have been relative scarce, especially in China and India, the two most populous countries in the world. Food allergy remains a clinical conundrum which embraces a wide range of controversies, established consensus, definitions, diagnostic criteria, and management practices across Asia, due to its diverse cultures and medical systems. Hong Kong as the most westernized metropolis in China represents one end of the high disease burden of allergic disease spectrum, in contrast with more rural and not so-well-developed regions. A recent questionnaire survey among preschoolers in Hong Kong found that food allergy is a common atopic condition.<sup>2</sup> To fill in gaps in our knowledge about infants, toddlers, and teens (0 to 14 years), we embarked on this population based questionnaire survey of self-reported adverse food reactions. This helped in estimating the disease burden and will help focus the direction of future research in China and Asia.

## Methods

The Department of Health commissioned the Department of Paediatrics and Adolescent Medicine and the School of Public Health, Li Ka Shing Faculty of Medicine, The University of Hong Kong, to conduct the first territory-wide Child Health Survey (CHS) in 2005/2006. The aim of the survey was to provide baseline data on the health and well-being of children aged 14 and below in Hong Kong in order to strengthen the Government's information based on the health status of the child population and to support evidence-based decision making in health policy, resources allocation, and provision of health services and programmes. The fieldwork was carried out from September 2005 to August 2006, with the use of face-to-face interviews and self-administered questionnaires. Households were chosen from the Register of Quarters maintained by the Census and Statistics Department by systematic replicated sampling. The percentage of quarters successfully enumerated (including those without children aged 14 and below) was 73.3%. A total of 7,393 land-based non-institutionalized children aged 14 and below in Hong Kong were identified, excluding those with non-Cantonese speaking parents and those living in non-built-up areas. The sample was representative of the 884 300 children in the target population.

The survey instrument was developed by the Department of Paediatrics and Adolescent Medicine and the School of Public Health, Li Ka Shing Faculty of Medicine, The University of Hong Kong, in consultation with the Department of Health and a group of experts (Appendix: supplementary information on questionnaire set). Information was obtained from the parent as proxy respondent for children aged 10 and below and from both parent and child for children aged 11 to 14. The study was approved by the IRB of the University of Hong Kong and publication of the data was approved by the Department of Health. The whole survey has been made available in the public domain on the Department of Health web site.<sup>3</sup>

## Statistical analysis

The Chi-squared test with Yates' correction was used for most analyses, such as in demographic grouping like sex and age. Global Health Performance was compared between non-food allergic and food allergic children and allergic children. Subgroup comparisons were also made between allergy to any food Vs peanut allergy and allergy to any food Vs shellfish allergy. The association of co-morbid atopic disorders (asthma, allergic rhinitis and eczema) between food allergic and non-food allergic children were compared by using the Chi-squared test with Yates' correction. 95% confidence intervals were calculated wherever appropriate. A significance level of  $p$ -value  $<0.05$  was used for all analyses.

## Results

Among the 7,393 respondents, 352 (4.8%; 95% CI 4.3-5.3%) reported having adverse reactions to foods. The prevalence of reported adverse food reactions by sex and age groups were tabulated (Table 1). More males than females reported adverse food reactions.

**Table 1.** Food allergy prevalence by sex and age groupings

	(n)	Food allergy Yes (n=352)	<i>p</i> -value	95% C.I.
Overall	7393	352 (4.8%)		4.3% - 5.3%
Sex		n (%)	<i>P</i> =0.0312	
Female	3554	149 (4.2%)		3.6% - 4.9%
Male	3839	203 (5.3%)		4.6% - 6.0%
Age group			<i>p</i> =0.7245	
'0 - 1	548	27 (4.9%)		3.4% - 7.1%
'2 - 5	1433	76 (5.3%)		4.3% - 6.6%
'6 - 10	2755	125 (4.5%)		3.8% - 5.4%
'11 - 14	2657	124 (4.7%)		3.9% - 5.5%

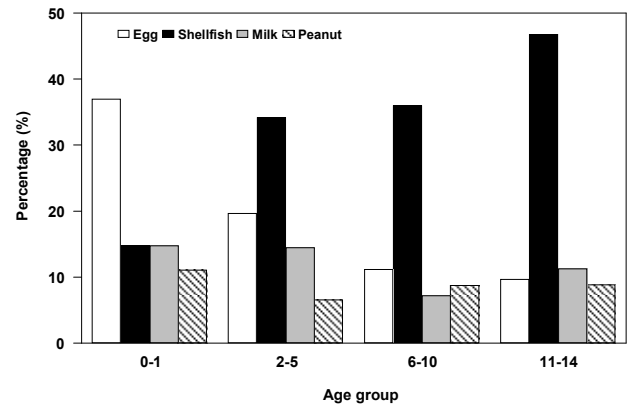
**Table 2.** Frequency of adverse food reactions by food items

Type of food allergy	Female (n=149)	Male (n=203)	p-value	Total (n=352)	95% C.I.
Shellfish	67 (45.0%)	66 (32.5%)	0.0232	133 (37.8%)	32.9% - 43.0%
Egg	26 (17.5%)	25 (12.3%)	0.2306	51 (14.5%)	11.2% - 18.6%
Milk and dairy products	16 (10.7%)	22 (10.8%)	1	38 (10.8%)	8.0% - 14.5%
Peanut	14 (9.4%)	16 (7.9%)	0.7569	30 (8.5%)	6.0% - 11.9%
Fruit	21 (14.1%)	9 (4.4%)	0.0026	30 (8.5%)	6.0% - 11.9%
Soya bean	8 (5.4%)	19 (9.4%)	0.2351	27 (7.7%)	5.3% - 10.9%
Meat	6 (4.0%)	9 (4.4%)	1	15 (4.3%)	2.6% - 6.9%
Fish	5 (3.3%)	9 (4.4%)	0.814	14 (4.0%)	2.4% - 6.6%
Nut	3 (2.0%)	3 (1.5%)	1	6 (1.7%)	0.8% - 3.7%
Monosodium glutamate	4 (2.7%)	0 (0%)	0.0659	4 (1.1%)	0.4% - 2.9%
Wheat	1 (0.7%)	1 (0.5%)	1	2 (0.6%)	0.2% - 2.5%
Others	22 (14.8%)	54 (26.6%)	0.0112	76 (21.6%)	17.6% - 26.2%
<i>Combine food allergy</i>			0.2096		
1 item only	118 (79.2%)	175 (86.2%)		293 (83.2%)	79.0% - 86.8%
2 items	21 (14.1%)	20 (9.9%)		41 (11.7%)	8.7% - 15.4%
≥ 3 items	10 (6.7%)	8 (3.9%)		18 (5.1%)	3.3% - 7.9%

\* Others (Broad bean, egg plant, duck's egg/ salted egg and undetermined)

**Frequency of adverse food reactions by food items**

The relative frequency of adverse food reactions by food items was tabulated (Table 2). Shellfish accounted for more than a third of all reactions. The second most common was hen's egg (14.5%), the third cow's milk and dairy products (10.8%) and co-fourth peanuts and combined fruits (8.5%). The relative frequency of the top 4 food items were compared by age groupings (Figure 1). There was a significant decrease in the relative frequency for egg allergy but an increase in the relative frequency for shellfish with advancing age. A majority of respondents (83.2%) had adverse reactions to a



**Figure 1.** Comparison of relative frequencies of common food allergies in different age groups

single food. About 10% had reactions to 2 and 4% reacted to 3 or more items. Although overall males had more adverse food reactions than females, females had statistically significantly more reactions to shellfish and fruit.

**Signs and symptoms of adverse food reactions**

The reported signs and symptoms of adverse food reactions were tabulated (Table 3). Out of 352 subjects who reported adverse reactions, 127 (36.1%) had urticaria and or angioedema and 79 (22.4%) had eczema exacerbations. Combined gastrointestinal symptoms accounted for 20.8 % of reactions (diarrhoea 12.8%; vomiting 5.4%; abdominal pain 2.6%). Fifty-five (15.6%) had anaphylaxis, and 7 (2%) had respiratory difficulties.

**Peanut allergy**

In the questionnaire, a set of questions was specifically asked to verify the occurrence of peanut allergy. The results were tabulated (Table 4). Of those who reported having ever had adverse food

**Table 3.** Signs and symptoms of adverse food reactions

Type of reactions	Total (n=352)	95% C.I.
Urticaria ± Angioedema	127 (36.1%)	31.2% - 41.2%
Exacerbated eczema	79 (22.4%)	18.4% - 27.1%
Anaphylaxis	55 (15.6%)	12.2% - 19.8%
Diarrhoea	45 (12.8%)	9.7% - 16.7%
Vomiting	19 (5.4%)	3.5% - 8.3%
Abdominal Pain	9 (2.6%)	1.4% - 4.8%
Respiratory difficulties	7 (2.0%)	1.0% - 4.1%
Restless/irritability	1 (0.3%)	0.1% - 1.6%
Others	10 (2.8%)	1.5% - 5.2%

reactions, 21 had been diagnosed to have peanut allergy by a doctor and 14 were suspected to have peanut allergy but no proper assessment had been made. The estimated prevalence of peanut allergy was 0.3% (95% C.I. 0.2 to 0.4%).

### **Rating of Children's Global Health**

The children's Global Health was either rated by their parents for age below 11 or rated by the teens themselves (age 11-14). The results of all respondents: children with any food allergy, children with peanut allergy and those with shellfish fish allergy, were tabulated by age group (Table 5). For age group 0-5 and age >11-14, the Global Health rated either by parents or teens themselves had comparable ratings between children with or without reported food allergy. For those aged 6-10, children with any food allergy as rated by parents had fair to poor global health in 11.3% of cases, compared with 6.3% for those without food allergy ( $p < 0.05$ ). Comparing peanut allergy to other type of food allergy, in age group 0-5, 35% of parents whose child had peanut allergy rated their global to be fair to poor in contrast with those with any type, who rated their global health to be fair to poor in only 7.5% of cases ( $p < 0.05$ ). Such an observation was not evident in the shellfish group. Children in this group had comparable global health scores across all age groups when compared with any type of food allergy.

### **Co-morbid atopic disorders (asthma, allergic rhinitis and eczema)**

The population's allergic disease burden was estimated in this survey using the ISAAC questionnaire and the results were tabulated (Table 6). Food allergic children, compared with overall population, have a significantly higher prevalence of all three atopic disorders (asthma, allergic rhinitis and eczema). They have 3-4 times higher rates for reported wheeze and 2-3 times for asthma, current

wheeze, and more symptomatic wheeze like awakening and dyspnoea during sleep. Also they have 2 fold higher rates of allergic rhinitis and 4 fold higher rates for eczema and current flexural eczema.

### **Discussion**

The prevalence data for food allergy in Hong Kong are limited. The previous relative small scale cross-sectional studies were carried out over a 10-year period. They offered piecemeal information about this public health concern. Our study is Hong Kong's first ever population based questionnaire survey on parent reported adverse food reactions.

It is generally assumed that questionnaire-based studies overestimate the prevalence of food hypersensitivity. The reported perceived prevalence of food hypersensitivity in Europe varies from 3.24% to 34.9%, which may be explained partly by the difference in reporting lifetime prevalence compared with point prevalence. However, of more importance is the apparent inverse correlation between response rate and prevalence. In general the higher the response rate, the lower the perceived prevalence.

The strength of our study is that it involved robust population sampling and designated and trained interviewers doing one-to-one and door-to-door interview. We have one of the best response rates (up to 75%) for this kind of study. This study is the first of this kind in Asia and China. In view of the rapid changes in epidemiology observed elsewhere, we think it is pertinent to keep tracking it in the future future.

### **Prevalence and epidemiology of food allergy**

The true prevalence of FA has been difficult to establish for several reasons. Although more than 170 foods have been reported to cause IgE-mediated reactions, most prevalence studies have focused on only the most common foods. The incidence and prevalence of FA may have changed over time, and many studies have indeed suggested a true rise in prevalence over the past 10 to 20 years.<sup>1,4</sup> Studies of FA incidence, prevalence, and natural history are difficult to compare because of inconsistencies and deficiencies in study design and variations in the definition of FA.

One meta-analysis<sup>5</sup> and 1 systematic review of the literature on the prevalence of FA have recently been published. The meta-analysis by Rona et al.,<sup>5</sup> which includes data from 51 publications, is stratified for children and adults and provides separate analyses for the prevalence of FA for 5

**Table 4.** Peanut allergy in Hong Kong

<b>Peanut allergy diagnosed</b>	<b>Number (%)</b>	<b>95% C.I.</b>
Often eats peanut but never has problem	7175 (97.1%)	96.6% - 97.4%
Uncertain because never or seldom eats peanut	148 (2.0%)	1.7% - 2.4%
Suspected to have peanut allergy but no proper consultation ever made	14 (0.2%)	0.1% - 0.3%
Has been diagnosed to have peanut allergy by doctor	21 (0.3%)	0.2% - 0.4%

**Table 5.** Food allergic children's global health in different age groups

Children's global health	Any food allergy			Peanut allergy*			Shellfish allergy*		
	No	Yes	<i>p</i> -value	Other allergy	Peanut	<i>p</i> -value	Other allergy	Shellfish	<i>p</i> -value
	n (%)	n (%)		n (%)	n (%)		n (%)	n (%)	
<b>Age 0 - 5 answer by parent</b>	n=1847	n=101	0.2692	n=93	n=8	0.0351	n=72	n=29	0.6434
Excellent to Good	1726 (93.4%)	91 (90.1%)		86 (92.5%)	5 (62.5%)		66 (91.7%)	25 (86.2%)	
Fair to Poor	121 (6.6%)	10 (9.9%)		7 (7.5%)	3 (37.5%)		6 (8.3%)	4 (14.0%)	
<b>Age 6 - 10 answer by parent</b>	n=2567	n=124	0.0427	n=113	n=11	0.7968	n=79	n=45	1
Excellent to Good	2406 (93.7%)	110 (88.7%)		101 (89.4%)	9 (81.8%)		70 (88.6%)	40 (88.8%)	
Fair to Poor	161 (6.3%)	14 (11.3%)		12 (10.6%)	2 (18.2%)		9 (11.4%)	5 (11.1%)	
<b>Age 11 - 14 answer by children</b>	n=2390	n=118	0.836	n=108	n=10	1	n=63	n=55	1
Excellent to Good	2092 (87.5%)	102 (86.4%)		93 (86.1%)	9 (90.0%)		54 (85.7%)	48 (87.2%)	
Fair to Poor	298 (12.5%)	16 (13.6%)		15 (13.9%)	1 (10.0%)		9 (14.3%)	7 (12.7%)	

foods: milk, egg, peanut, fish, and crustacean shellfish. The investigators report an overall prevalence of self-reported FA of 12% and 13% for children and adults, respectively, for any of these 5 foods. This compares to a much lower value of 3% for adults and children combined when assessed by self-reported symptoms plus sensitization or by double-blind, placebo-controlled food challenge (DBPCFC). These data emphasize the fact that FAs are over-reported by patients and that objective measurements are necessary to establish a true FA diagnosis. For specific foods, results for all ages show that prevalence is highest for milk (3% by symptoms alone, 0.6% by symptoms plus positive skin prick test (SPT), and 0.9% by food challenge).

The systematic review by Zuidmeer et al.,<sup>6</sup> which includes data from 33 publications, presents an epidemiological data review of allergy to fruits, vegetables/non-peanut legumes, tree nuts, wheat, and soy. The results demonstrate that the reported prevalence for these foods is generally lower than for the 5 foods reported in Rona et al's meta-analysis. Once again, the prevalence of FA is much higher when assessed using self-reporting than when using sensitization or food challenge.

We attempted to make comparisons of self reported symptoms from pooled international data Vs Hong Kong data for self-reported symptoms in all age groups (Figure 2).

The Hong Kong data are in many ways similar to reported pooled international data, except that for cow's milk. There is a longstanding believes that the

Chinese have a much lower prevalence of peanut allergy; this is the first time that data have shown that modern Hong Kong Chinese, with a predominantly western life style, have a comparable prevalence to other groups. The data for combined seafood (fish and shellfish) allergy is comparable to international data, though the rate in Hong Kong is slightly higher. The lower prevalence of cow's milk allergy in Hong Kong means that a separate infant and toddlers study, with a much larger sample size to verify the results is required, and also suggests that it would be worth investigating protective and risk factors, such as breast feeding practice and the timing of introduction of cow milk.

Two additional studies<sup>1,7</sup> provided US FA prevalence data around the time of our survey, which made some meaningful comparison possible. In data obtained via proxy that reported on FA from the National Health Interview Survey in 2007, the Centers for Disease Control and Prevention (CDC) found that approximately 3 million children under age 18 years (3.9%) reported an FA in the previous 12 months.<sup>1</sup> The data were remarkable similar to the results of our survey of Hong Kong Chinese up to age of 14. Another US study analyzed national data from the Infant Feeding Practices Study II, a longitudinal mail survey from 2005 to 2007 of women who gave birth to a healthy single child after a pregnancy of at least 35 weeks. The survey began in the third trimester of pregnancy and continued periodically thereafter up to age 1.<sup>7</sup> Probable FA was defined either as a doctor-diagnosed FA or as

**Table 6.** Comparison of disease burden of co-morbid atopic disorders (asthma, allergic rhinitis and eczema) between food allergic children and the overall population

Co-morbid atopic disorders	Overall			Food allergy		p-value
	Prevalence, n (%)	95% C.I.	Yes n (%)	No n (%)		
Ever Wheeze	244 (3.3%)	2.9% - 3.7%	25 (10.3%)	219 (3.1%)	<0.0001	
Asthma ever	288 (3.9%)	3.5% - 4.4%	32 (9.1%)	256 (3.7%)	<0.0001	
Current wheeze	154 (2.1%)	1.8% - 2.4%	18 (5.1%)	136 (2.0%)	0.0001	
Wheezing attack in past year					0.0005	
1-3 episodes	103 (1.4%)	1.2% - 1.7%	12 (3.4%)	91 (1.3%)		
4-12 episodes	23 (0.3%)	0.2% - 0.5%	2 (0.6%)	21 (0.3%)		
>12 episodes	27 (0.4%)	0.3% - 0.5%	4 (1.1%)	23 (0.3%)		
Awakening from sleep due to dyspnea in past year					0.0002	
Never	94 (1.3%)	1.0% - 1.6%	10 (2.8%)	84 (1.2%)		
<1 per week	53 (0.7%)	0.6% - 0.9%	8 (2.3%)	45 (0.6%)		
≥1 per week	4 (0.1%)	0.02% - 0.14%	0 (0%)	4 (0.1%)		
Speech-limiting dyspnea in past year	15 (0.2%)	0.12% - 0.33%	6 (1.7%)	9 (0.1%)	<0.0001	
Current rhinoconjunctivitis	929 (12.6%)	11.8% - 13.3%	73 (20.9%)	856 (12.3%)		
Allergic rhinitis ever	1736 (23.5%)	22.5% - 24.5%	155 (44.2%)	1581 (22.7%)	<0.0001	
Current flexural eczema	100 (1.4%)	11.1% - 16.4%	29 (8.3%)	71 (1.0%)	<0.0001	
Eczema ever	841 (11.4%)	10.7% - 12.1%	155 (44.1%)	686 (9.9%)	<0.0001	
Sleep disturbance due to eczema in past year					<0.0001	
Never	41 (0.6%)	0.4% - 0.8%	8 (2.3%)	33 (0.5%)		
<1 per week	22 (0.3%)	0.2% - 0.5%	7 (2.0%)	15 (0.2%)		
≥1 per week	16 (0.2%)	0.13% - 0.35%	8 (2.3%)	8 (0.1%)		

the presence of food-related symptoms (i.e., swollen eyes, swollen lips, or hives). Of over 2 thousand 4 hundred mother-infants pairs, 60% completed all the serial questionnaires, which included detailed questions about problems with food. About 500 infants were characterized as having a food-related problem, and 6% were classified as probable FA cases by 1 year of age. There were remarkable similarities between our study and this US study in terms of sample size and the definition of perceived food allergy. Among our close to 550 Chinese infants about 5% of them had perceived food allergy.

#### ***Prevalence of allergy to specific foods, food induced anaphylaxis, and food allergy with co-morbid conditions.***

##### *Seafood allergy*

In 1999-2003, Smite et al. reported a Hong Kong A&E case series<sup>8</sup> of two hundred fifty-two children and adults with anaphylaxis; of these 90% stated a clear precipitant that they believed to be responsible for the anaphylactic reaction. Food as a precipitant

was reported by almost a half of the patients. None of these patients died and seafood accounted for 70% of the food induced anaphylaxis cases. In 2004, Wu and Williams found in a cohort of eighty-four consecutive Hong Kong shellfish allergic adult patients, that one third of the patients reported a history of severe anaphylaxis.<sup>9</sup> In 2009, Leung et al. reported that food allergy was a common atopic disorder in Hong Kong pre-school children (n 3677, age 2-7y), ased on a questionnaire survey, and that prevalence rates were comparable to those for Caucasians.<sup>10</sup> The six leading causes of self-reported food allergy were shellfish, egg, peanut, cow's milk, bovine protein like beef, and tree nuts. In 2010, Ho et al. identified that food allergy was the leading cause for hospitalized Hong Kong children with severe systemic allergic reactions and anaphylaxis. Shellfish and non-specific seafood account more than a third of all food anaphylaxis cases.<sup>11</sup> Our current study again showed that in 1 in 3 with perceived food allergy it is attributed to shellfish, which further substantiated the impression that shellfish is a major concern in Hong Kong. Sicherer

et al.<sup>12</sup> used random calling by telephone of a US sample to estimate the lifetime prevalence rate for reported seafood allergy. Rates were significantly lower for children than for adults. Rates were significantly higher for women than for men. Interestingly in this regard, our study also verified in a much younger group that girls had a significant higher shellfish allergy than boys. The reason is unclear at this stage.

#### *Peanut and tree nut allergy*

Investigators from the United States and several other countries have published prevalence rates for allergy to peanut and tree nuts. Where prevalence and sensitization are measured in the same study, the prevalence is always less than the rate of sensitization. The prevalence of peanut allergy in the United States is about 0.6% of the population. The prevalence of peanut allergy in France, Germany, Israel, Sweden, and the United Kingdom varies between 0.06% and 5.9%. The prevalence of tree nut allergy in the United States is 0.4% to 0.5% of the population. The prevalence of tree nut allergy in France, Germany, Israel, Sweden, and the United Kingdom varies between 0.03% and 8.5%. Our study revealed a 0.4% rate of highly probable or confirmed peanut allergy and alerted us to the fact that the Asian population should not overlook peanut allergy, which is now one of the biggest concerns in Western countries due to its severity, persistence and its possibly increasing prevalence.

#### *Milk and egg allergy*

Two European studies have examined the prevalence of milk and egg allergy. In a Danish cohort of more than 1700 children followed from birth through age 3, children were evaluated by history, milk elimination, oral food challenge, and SPTs or sIgE.<sup>13</sup> Allergy to milk was suspected in 6.7% and confirmed in 2.2%. Of confirmed cases in children, slightly more than a half had IgE-mediated allergy, and the remaining were classified as non-IgE mediated.

In a Norwegian cohort of 3,600 children followed from birth until age 2, parents completed questionnaires regarding adverse food reactions at 6-month intervals.<sup>14,15</sup> Those children who had persistent complaints of milk or egg allergy underwent a more detailed evaluation at the age of 2 years, including skin prick testing and open- and double-blind oral food challenges. At the age of 2.5 years, the combination of the prevalence of allergy and intolerance to milk was estimated to be 1.1%.

Most reactions to milk were not IgE mediated. The prevalence of egg allergy was estimated to be 1.6%, and most egg reactions were IgE mediated. Of a similar design, a recent report on the overall prevalence of challenge-proven FA in 0- to 1-yr-old children in Chongqing, China, was 3.8% (95% CI, 2.5-5.9%) with 2.5% egg allergic and 1.3% cow's milk allergic. The estimated egg allergy in our study of infants was 1.85% and milk was 0.75%. Based on perceived or self-reported allergy, the prevalence of cow's milk allergy seemed much lower than expected, which warrants a larger sample size to verify the findings.

#### *Food-induced anaphylaxis*

Our study found 15.6% (a relative high rate) of children with food allergy had anaphylaxis. That translated into an alarmingly high anaphylactic risk of 700/100,000 of the population aged under 14. This corroborated one recent reported rate of anaphylaxis to food which was about 10% among all reported adverse food reaction in the age group 2-7y in Hong Kong Children.<sup>11</sup> Using hospitalization data and ICD-9-CM coding, the previous estimated anaphylaxis risk was 1 in 100,000 and angioedema was 7/100,000 hospitalizations in Hong Kong children under 18.<sup>8</sup> Our current study and the previous hospital study came from a different set of denominators that render direct comparison of not much meaning, if not impossible. The relative low hospitalization rate for anaphylaxis in Hong Kong may have other confounders such as a different admission policy or health seeking behavior that deserve further study.

Five US studies assessed the incidence of anaphylaxis related to food; all used administrative databases or medical record review to identify cases of anaphylaxis.<sup>4,16-19</sup> These studies found wide differences in the rates (from 1/100,000 population to as high as 70/100,000 population) of hospitalization or emergency department visits for anaphylaxis, as assessed by International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes or medical record review. These variations may be due to differences in the study methods or differences in the populations (Florida, New York, Minnesota). The proportion of anaphylaxis cases thought to be due to foods also varied between 13% and 65%, with the lowest percentages found in studies that used more stringent diagnostic criteria for anaphylaxis. One study reported that the number of hospitalizations for anaphylaxis increased with increasing age in those younger than 20 years,<sup>17</sup>



while another study reported that the total number of cases of anaphylaxis were almost twice as high in children as in adults. Most of experts agree that any estimate of the overall incidence of anaphylaxis is unlikely to have utility because such an estimate fails to reflect the substantial variability in patient age, geographic distribution, criteria used to diagnose anaphylaxis, and the study methods used.<sup>17</sup>

#### ***Food allergy with co-morbid conditions***

We used the ISAAC questionnaire population survey to estimate the population allergic disease burden. Food allergic children compared with overall population have a significantly higher prevalence of all three atopic disorders (asthma, allergic rhinitis and eczema). They have 3-4 times higher rates for wheeze and 2-3 times for asthma, current wheeze, and more symptomatic wheeze like awakening and dyspnoea during sleep. Also they have a 2 fold higher rate of reported allergic rhinitis and a 4 fold higher rate of reported eczema and current flexural eczema.

This corroborates the results of a recent CDC stud; children with FA are about 2 to 4 times more likely to have other related conditions such as asthma (4.0 fold), AD (2.4 fold), and respiratory allergies (3.6 fold), compared with children without FA.<sup>1</sup>

These associations partly reflect the fact that the perceived food allergy of study subjects was compatible with IgE-FA and as a spectrum of allergy march.

Several studies reported on the co-occurrence of other allergic conditions in patients with FA,<sup>20-22</sup> such as: 35% to 71% with evidence of AD; 33% to 40% with evidence of allergic rhinitis; 34% to 49% with evidence of asthma. In patients with both AD and FA<sup>23</sup>: 75% have another atopic condition; 44% have allergic rhinitis and asthma 27% have allergic rhinitis; 4% have asthma, without another atopic condition.

The prevalence of FA in individuals with moderate to severe AD is 30% to 40%, and these patients have clinically significant IgE-mediated FA (as assessed by some combination of convincing symptoms, SPTs, specific IgE levels, or oral food challenges)<sup>24</sup> or a definite history of immediate reactions to food.<sup>25</sup>

A retrospective review of the records of 201 children with an ICD-9 diagnosis of asthma found that 44% (88 of 201) have concomitant FA.<sup>26</sup>

Previous Hong Kong studies on selected populations also reported the co-occurrence of

atopic manifestation with FA. In 2000, Leung et al.<sup>27</sup> reported that sensitization to common food allergens was found 1 in 4 of the Hong Kong asthmatic children, though significant food sensitization, with food-specific IgE levels above the 95% predictive values for clinical food allergy, as proposed by Sampson, was only found in two patients for peanut and three subjects for egg white. Less than 5% of asthmatic children had peanut sensitization.<sup>28</sup> In 2008, Hon et al, reported that one third of a group of Hong Kong Chinese children with eczema had peanut sensitization by skin prick test, whilst only 7% of children with urticaria but without eczema had peanut sensitization.<sup>29</sup>

The explanation for such a co-occurrence is quite obviously that children with FA may be especially likely to develop other allergic diseases. The above studies have been criticized for selection bias, due to the fact that most of the studies were performed in tertiary settings, but our study using a community population sampling helps to clear up such suspicions.

#### ***Quality-of-life issues associated with food allergy***

Leung et al. reported that quality of life was impaired in Hong Kong Chinese preschooler (2-7y) children with parent-reported adverse food reactions. Current food avoidance and adverse food reactions caused by multiple foods were independent risk factors for lower parental QoL.<sup>30</sup> Our study found that the older age group (6-10 y) also seems to be affected by perceived poor global health, as rated by parents. Also, parents whose young children (0-5y) had peanut allergy are perhaps the most affected group. Whether food allergy is an independent risk factor is not clear at this stage, as food allergic children tend to have many other co-morbid atopic manifestations.

#### ***Future studies***

It is essential that studies using consistent and appropriate diagnostic criteria be initiated to understand the incidence, prevalence, natural history, and temporal trends of FA and associated conditions. A recent example of a comprehensive approach to assessing the prevalence, health care costs, and basis for FA in Europe is the EuroPrevall project (<http://www.europrevall.org>). This European Union-supported effort has focused on characterizing the patterns and prevalence of FA in infants, children, and adults across 24 countries. The EuroPrevall-INCO project has been developed to evaluate the prevalence of food allergies in China,





India and Russia using the standardized methodology of the EuroPrevall protocol used for studies in the European Union. Hong Kong is one of centres of this multi-centre-multi-nation comparative epidemiology study. The Chinese result is eagerly awaited as confirmation of food allergies by double blind food challenge will be conducted.<sup>31</sup>

## Conclusion

This survey has provided the first population based epidemiological information related to food allergy amongst child and younger teenage population of Hong Kong. The results should provide significant reference values and serve as baseline information for subsequent surveys. A population based childhood food allergy health survey should be conducted regularly to update policy makers and health professionals, in order to support evidence-based decision making in health policy, resources allocation and provision of health services and programmes.

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