

## Socio-Demographic Factors of Allergy Awareness Among Pre-University Student In Selangor

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### Abstract

Allergic disease is a worldwide public health issues and substantially growing over the past 20 years. Due to drastically changes of environmental and dietary culture within the population, Malaysia as one of the developing country is no exception to face the same problem. This study aimed to assess the awareness of allergy diseases and its prevalence using cross-sectional survey method. This study that has been conducted to 138 students from University Teknologi Mara Cawangan Dengkil, Selangor, Malaysia. A self-administered questionnaire was used as an instrument for data collection. Based on sociodemographic data, the mean of knowledge between science and non-science students showed the significant difference. Respondents from Science course score significantly higher for part B ( $4.54 \pm 1.654$ ) compare with other courses. The outcome of the study also showed that, among 138 respondents,  $n=80$  (58%) of them perceived themselves to suffer allergy diseases and its symptoms. Common food to cause food allergy in this study were identified as seafood with  $n=43$  (31.25%) followed with dust with  $n=40$  (29%), peanuts with  $n=14$  (10.1%). The study also indicated the intricate situation of cross reactivity as  $n=21$  (15.2%),  $n=6$  (4.3%) and  $n=1$  (0.7) of respondents suffered with two, three and four multi allergy reaction respectively. The factor such as family history which subjected to predisposition of genetic factor was strongly associated with occurrence of allergic among respondents. It determined from Chi Square Test ( $X^2$ ) that showed that, there is high significant association ( $P < 0.001$ ) between parental allergies with respondents allergies. As overall, it can be conclude that the knowledge of allergy term, cause and prevention were relatively low among population under study as compared to the previous study.

**Index Terms:** Allergy Prevalence, Awareness, Food Allergy, self-perceive

### Introduction

Allergy disorder or referred as an “allergic epidemic” has raise public concern in Malaysia. In Asia alone, the prevalence of allergic disease has increased significantly over the last decade, with asthma cases rising from 0.8% to 29.1% and allergic rhinitis from 5% to 45% during the same period (Murugappan, 2016). Allergy has been defined as an abnormal hypersensitivity reaction initiated by immunological mechanisms (Ruby *et al.*, 2013; ASCIA, 2016). Allergy mechanism can be divided into two phases; sensitization and effector phases. In the sensitization phase, effector Th2 cells produce pro-inflammatory interleukin such as IL-4, IL-5, and IL-13. IL-4 and IL-13 to induce the B cells to produce allergen-specific IgE antibodies. The allergen-specific IgE then binds to the high-affinity FcεRI on the surface of mast cells or basophils, thus lead to sensitization. During the effector phase, when the body encounter the same allergen, it causes the cross-linking of IgEFcεRI complexes on sensitized basophils and mast cells (Cezmi *et al.*, 2015). These immunologic cell will be activated and subsequently release the mediators such as histamines, cytokines and chemokines that are responsible to cause immediate hypersensitivity reaction (ASCIA, 2016; Cezmi *et al.*, 2015).

## Literature review

Prevalence of allergy over lifetime.

The differences in food sensitization do exist among different countries, and even within the population theoretically. This is depending on the possible associated exposure or protective factors faced in certain geographic region. Allergic disease covers a list of diseases such as allergic rhinitis, allergic conjunctivitis, rhinosinusitis, asthma, atopic eczema, food allergy, anaphylaxis, urticarial, angioedema, allergy to insect, drugs and biological agent (Ruby *et al.*, 2013). Allergic diseases can affect people at any age with multiplicity of symptom. Several longitudinal studies provide evidence on sequential development of atopic manifestations during childhood until adulthood. It is because allergic march that shown as early as in infant age potentially develops through time (Yadav, 2009; Ober & Yao, 2012). Atopic dermatitis and food allergy typically develop in infancy followed by asthma and/or allergic rhinitis in childhood. About 30% of children with atopic dermatitis developed asthma, and nearly 66% develop allergic sensitization and symptoms of allergic rhinitis in older age (Ober & Yao, 2012). As cited in references (Margaret & Faizal, 2015), that atopic dermatitis and allergic rhinitis are the chronic diseases among childhood and its prevalence was differ between older and younger children. The prevalence of allergy rhinitis was higher in older children compared to the younger one but the pattern for atopic dermatitis or eczema was vice versa which significantly higher in infant less than 2 years old compared to older children (Yadav, 2009).

The genetic factor of allergy disease

Allergy is one of the communal multifactor disorders that may cause by genetic predisposition or atopy, environmental factors and allergen exposure. Epidemiological and genetic research indicated that genetic factor contributes up to 80% to allergy heritability (Cezmi *et al.*, 2015; Ober & Yao, 2012). As the main contributor to the allergy pathophysiology, it showed varying contribution depending on types of allergy. As example, the heritability contribution for asthma was 33%, while 91% for allergic rhinitis, 71% and 84% for atopic dermatitis (eczema) (Ober & Yao, 2012). Another example of study to indicate the heritability factor as the most influential cause to allergy conducted among twins. The clinical test on peanut allergy which has been done to identical twins indicated that there was higher concordance rate between the identical twin which is 64.3% compared to dizygotic twins (6.8%) (Liu *et al.*, 2009). As related to this study, parental atopy status was considerate to influence various allergic manifestations among respondents.

A genome-wide association studies (GWAS) was developed to observe genetic variants in different individuals of affected or non-affected subjects (Portelli *et al.*, 2015). Genes that control both innate and acquired immune system have been identified as multiple genes. Through linkage analysis and gene association studies, several genes have been mapped and identified with confidence such as *DPP10*, *PCDH1*, *HLA*, *NPSR1*, *PHF11*, *PLAUR*, *ADAM33*, *IL10*, *CD14*, *IL4*, *IL13*, *ADRB2*, *HLA-DRB1*, *HLA-DQB1*, *TNFA*, *FCER1B*, *INPP4A*, *STAT6* and *IL4RA* to cause asthma (Portelli *et al.*, 2015) This genes affect the epithelial secretion of epithelium lining within respiratory tract which is important to develop asthma (Portelli *et al.*, 2015; Ober & Yao, 2011). Other than that, genes such as *HLA-DRB1*, *HLA-DQB1*, *HLA-DPBI*, *CD14*, *FOXP3*, *STAT6*, *SPINK5*, *IL10* and *IL13* were identified to involve in the incidence of food allergy (Hong *et al.*, 2009).

Allergy Awareness among society

Despite the high prevalence of allergic diseases, lack of data in public awareness on food allergy is a potential research breakthrough. The survey from Allergy-Free Nation Survey by MSAI (Malaysian Society of Allergy & Immunology) indicated that 28% from 7132 respondents do not acknowledge that there is no cure for allergy (Zhafaran, 2016). To encounter this issue, in Malaysia itself MSAI (Malaysian Society of Allergy & Immunology) has been developed to increase the knowledge and awareness of allergy as well as food allergy at community and national level (Zhafaran, 2016; Food Safety Authority of Ireland Allergens, 2010; Food Allergy and Anaphylaxis Network Education; Madsen, 2005).

The misinterpretation of food intolerance as food allergy is the common highlighted issues among the public. It is because these two have resemblance of symptom that difficult to differentiate. Another

issue is that, allergy rhinitis is often associated with other inflammatory conditions such as allergic conjunctivitis, rhinosinusitis and asthma which often being ignored, misdiagnosed and mistreated (Scadeling, 2015; Chawes *et al.*, 2010). Allergic rhinitis also is one of the most common chronic disease in childhood. However, a lot of undertreated allergic rhinitis among children is due to the assumption that it is as the same as common cold or flu. Even though they share several common symptoms such as runny nose, blocked nose and sneezing, they are completely different. Allergy rhinitis is not caused by viruses and may persists until the allergen is gone (Robinson & Ficca, 2012). In certain cases of allergy disease, the symptoms will become more severe if not treated properly. Some might also underestimate the seriousness of allergy diseases. Untreated allergy diseases not only painful but can cause quality-to-life impairment such as poor-quality sleep and fatigue. Thus, it is a prodigious challenge to potential impacted stakeholder such as the parents, teachers, school and university management as well as medical practitioner to be conversant to provide safe food as well as a safe environment for risky allergy patients (Robinson & Ficca, 2012). People should be acknowledged and not hide away or take allergic diseases lightly as they could bring negative impacts if not treated properly.

#### Allergy avoidance as allergy prevention strategy

Since there is no established treatment for allergy except of immune therapy treatment which believed to be costly, several prevention strategies which more economical might be suggested to allergy patients for faster recovery. One of them is allergen avoidance in which recommended at all allergy severity levels. A trial has been conducted involving nine allergic asthma patients' shows a significant reduction of medication after two months living in a hospital room (Platts-Mills *et al.*, 2003). This indicates how allergen avoidance has a major effect in improving the condition of allergic patients. This method compromises a successful treatment and prevention via allergen avoidance. However proper diagnosis should be conducted by qualified allergist, so that it could not lead to the unnecessary food avoidance which may affect the nutritional status of individual in long term.

#### Methodology

Allergy diagnosis can be done in two steps starts with medical history and followed by physical examination involving laboratory allergy test (Ruby *et al.*, 2013; Robison, 2014). In this study, a cross-sectional quantitative study was conducted at UiTM Kampus Dengkil, Selangor Malaysia. 138 of students from diverge state of Malaysia who enroll the foundation program from 2017 and 2018 were recruited by convenience sampling method. The chosen of this group of respondents was due to the practicality to get sufficient number of respondents which represent Malaysia as whole. It because this foundation program enrolled by student from all over Malaysia. Other than that, our interest rely on the nature of the respondents at this age who commonly leaving home for the first time and fully responsible for their food intake thus effect their decision on managing food allergy if they have any. The sample size calculation was determined using specified absolute precision with anticipated population (P) of 40% or 0.5, 95% confidence interval (at a Z-score of 1.96) and absolute precision of 5%, and a 10% non-response rate (Lwanga & Lemeshow, 1991). References Ober & Yao (2012), Robison (2014) and American Academy of Allergy, Asthma and Immunology (2017) has been used to construct and adapt based on the questionnaire as an instrument of the study. The questionnaire was design in a mixed dichotomous question with yes, no and not sure answer together with five-point Likert rating scale question from strongly disagrees to strongly agree. Part I of the questionnaires was included demographic factor which covered variables such as ethnicity, age, and gender and health status. On the other hand, Part II of the questionnaire also designated to access attitude and knowledge of allergy among respondents. It divided into 3 parts, which Part (a) indicated clinical manifestation of allergy which respondents have to self-diagnose their allergy status according to the common symptom of allergy; Part (b) indicated respondents knowledge about allergy term, cause and symptom; and Part (c), indicated respondent's and practice towards allergy prevention and treatment. The reliability of the questionnaire was validated using the test-retest reliability. A pilot study was conducted among 25 respondents in which they were required to answer 18 questions. A week later,

they were required to re-answer the questionnaire. The mark before and after one week were analyzed using bivariate correlation in which a highly significant strong correlation was obtained ( $r = 0.946$ ,  $p < 0.001$ ,  $n = 25$ ).

### Result and discussion

Table 1 shows the demographic data together with the prevalence of food allergen. Result indicated that 115 (83%) out of  $n = 138$  respondents were female and 23 (16.7%) were male students. Malays was the major ethnicity in this study with  $n = 134$  (97.1%) followed with others  $n = 4$  (2.9%). Science student represents the major respondents of this study with  $n = 108$  (78.3%) followed with engineering  $n = 15$  (10.9%), law  $n = 8$  (5.8%) and TESL  $n = 7$  (5.1). A total of 110 (79.7%) respondents had no serious health issues while 28 (20.3%) of them had it.

Allergy prevalence presented in Table 1 showed that  $n = 80$  (58%) of respondents facing allergy problems. Seafood such as shrimp was the most common implicated food allergen with  $n = 43$  (31.25%) followed with dust with  $n = 40$  (29%), peanuts with  $n = 14$  (10.1%). Egg, fish, latex and insect bites showed the same prevalence with  $n = 3$  (2.2%) followed with others with  $n = 7$  (5.1%) and none for cow milk and soy.

Table 1: Demographic and Food Allergen Data

		N	%
Gender	Male	23	16.7
	Female	115	83.3
Ethnicity	Malay	134	97.1
	Chinese	0	0
	Indian	0	0
	Others	4	2.9
Programme	Science	108	78.3
	Engineering	15	10.9
	TESL	7	5.1
	Law	8	5.8
Health Issues	No	110	79.7
	Yes	28	20.3
Allergy	Have allergy	80	58
	Egg	3	2.2
	Fish	3	2.2
	Seafood	43	31.2
	Cow milk	0	0
	Soy	0	0
	Peanuts	14	10.1
	Dust	40	29
	Latex	3	2.2
	Insect bites	3	2.2
	Others	7	5.1
	Numbers of allergy	0	58
1		52	37.7
2		21	15.2
3		6	4.3
4		1	0.7

This data was comparable to another reported data from Malaysia Allergy Prevention (MAP) that the food such as seafood such as shrimp was the major source of food allergen with 89.9% (Malaysian Allergy Prevention (MAP), 2014; Wan Mohamad *et al.*, 2016; Gendeh *et al.*, 2000; Kumar *et al.*, 2007). However, the data represented diverges prevalence pattern for another sources of allergen such as tree nut and soy. In this study, tree nut or peanut was not the common source of allergen with only 10.1% of prevalence compared to 47% as reported by MAP. Other than that, there was no prevalence of soy allergy in this study as compared to 44.3% as reported by MAP (2014).

Another study also showed that, there was a pattern on food sensitization from infant to childhood. There was higher sensitization rate to eggs with significant differences of ( $p < 0.01$ ) and cow's milk ( $p = 0.044$ ) in patient below two years old compared to 2 to 10 years old. However, there was no significant differences for shrimp ( $p = 0.29$ ), wheat ( $p = 0.23$ ) and soy ( $p = 0.057$ ) between the two groups (Yadav & Naidu, 2015) which explained that while reaching teenager hood, sensitization to shrimp, wheat and soy were not developed or suppress (Yadav & Naidu, 2015). However, as this

study which focusing on young adult, the outcome is against the fact that seafood or shrimp sensitization could be suppressed among teenager hood or in young adult since shrimp becoming the major sources of sensitization among the respondents. Interestingly, the pattern for house dust mites allergy was vice versa. In previous study, the significant difference between the two groups; below two years old group and 2 to 10 years old group, of house dust mites ( $p < 0.01$ ) dramatically increased in the older children from 2 to 10 years old (Yadav & Naidu, 2015), which also corresponded to this study outcome that, house dust mites was the second implicated allergen with 40 (29%) statistically. This result indicated that there is closed correlation between food allergen such as seafood or shrimp allergy and environmental factors to be the cause of allergy prevalence. It summarized that not just food allergen was responsible for sensitization, environmental factor also plays as an important role to increases the allergy prevalence. However, this study is subjected to self-perceived only. Ambiguous mistake such as misinterpretation of allergy as food allergy due to environmental exposure can be occur without proper allergy diagnosis test in laboratory.

The data in Table 1 also represented the occurrence of multi allergy situation, where  $n=21(15.2\%)$ ,  $n=6(4.3\%)$  and  $n=1(0.7)$  suffered with two, three and four multi allergy reaction respectively compared to single allergy sufferer with  $n=52(37.7\%)$ . Seafood and house dust mites seem to be overlapped in its prevalence statistic. This is due to the presence of tropomyosin that identified in Crustacea, such as shrimp which also exist in parasites such insects like cockroach, grasshopper, and dust mite with the same homology sequence (Wan Mohammad *et al.*, 2016; Sicherer *et al.*, 2004). So, the cross-reactivity between these two allergens was notorious and foreseeable. In molecular aspect, food allergy is heavily influenced by gene- environment interactions and gene-gene interactions (Liu *et al.*, 2004). Gene- gene (GxG) interactions are interaction between genetic variants which is also one of the main contributors for critical human disease while Gene-environment (GxE) interactions shows combination interaction between environmental factors such as exposure to microbes and genetic predisposition (Liu *et al.*, 2004).

Table 2 generalized the allergy symptom among students and their parents. The pattern of particular allergy symptom can be determined throughout of life (Robinson & Ficca, 2012). As the population under this study focused to young adult, the data was valuable to pattern the allergy symptom over life span, started for infant, teenager hood until adulthood.

Table 2: Allergy symptom and diseases among students and their parents.

Allergy	Father		Mother		Students	
	n	%	N	%	n	%
Rhinitis	1	0.7	2	1.4	10	7.2
Conjunctivitis	0	0	0	0	2	1.4
Eczema	3	2.2	7	5.1	13	9.4
Anaphylaxis	0	0	1	0.7	0	0
Asthma	3	2.2	9	6.5	17	12.3
Dry and itchy rashes at skin	6	4.3	10	7.2	22	15.9
Sneezing	10	7.2	10	7.2	35	25.4
Itchy Nasal Cavity	2	1.4	5	3.6	20	14.5
Prolonged cold	1	0.7	1	0.7	6	4.3
Runny and block nose	5	3.6	9	6.5	25	18.1
Itchy and red eyes	0	0	2	1.4	11	8
Shortness of breath	4	2.9	3	2.2	10	7.2
Wheezing	1	0.7	1	0.7	7	5.1
Hives	0	0	0	0	1	0.7
Swelling of eyes and mouth	0	0	1	0.7	2	1.4
Diarrhoea	3	2.2	1	0.7	3	2.2
Blood in stool	0	0	1	0.7	0	0

In children below two years old, atopic dermatitis was the most common symptom with (65.7%) whereas in children from 2 to 10 years it was rhinoconjunctivitis (74.5%) (Yadav Naidu, 2015). It also supported by another study that atopic dermatitis symptom was less common among adulthood compared to childhood (ASCIA, 2016). Another self-reported allergy survey among 13-14-year-old children in Alor Setar, Klang Valley and Kota Bharu determined that rhinoconjunctivitis as the main allergy symptom ranged from 12.55 to 16.8% of occurrence compared to asthma which ranged from 9% to 10.8% and wheezing which ranged from 5.8% to 11.6% (Wong *et al.*, 2013).

In this study different pattern of allergy symptom among young adult has been shown. As compared to the symptom among adulthood as presented in references Malaysian Allergy Prevention (MAP) (2014), frequencies for certain symptom in this study such as allergy rhinitis (7.2%) and asthma (12.3%) showed lower frequency. However, the pattern showed high frequency for respiratory

symptom such as sneezing (25.4%) was the common symptom among respondents, followed with runny and block nose (18.1%) and itchy nasal cavity (14.5%) despite atopic dermatitis in childhood. All symptom of respiratory system is closely associated with the symptom of allergy rhinitis which was common among adulthood (Yadav & Naidu, 2015). Different pattern of symptom can be determined in adulthood. The study done by MAP represented that the common symptom among adulthood were food allergies followed with atopic dermatitis, rhinitis or hay fever and asthma with 55.2%, 42.4% 29.1% and 27.4% respectively (Malaysian Allergy Prevention (MAP), 2014).

Overall, the pattern for allergy prevalence is difficult to be illustrated comparatively to other study via limitation of this study methodology with other study that used clinical diagnosis method rather than self-perceived. However, it still beneficial to see the symptom pattern of allergy that can range from mild to severe or can be either worsen nor improve through time (ASCIA, 2016). Overall, this indicate that, there is no enough evidence to conclude the standard pattern of the development of allergy symptom throughout life time and it subjected to many confounding factor such as environmental factor.

Table 3 showed the association between student allergy and parental allergy. Chi Square Test ( $X^2$ ) shows that there was high significant association ( $P < 0.001$ ) between parental allergy status and the respondents. Among the 49 parents with allergies, 35 (71.4%) of their son and daughter also have allergies. Chi Square Test among mother and fathers with allergies also showed high significant association with 39 and 26 mother and fathers respectively having allergies. A total of 30 (76.9%) students have mother who also have allergies while 18 (69.2%) of students have fathers who also have allergies.

Table 3: Association of parental allergy with child allergy

		Student with allergies		$X^2$	P
		No (n=69) (%)	Yes (n=69) (%)		
Parents with allergies	No (n=89) (%)	55 (79.7)	34 (49.3)	13.955	<0.001
	Yes (n=49) (%)	14 (20.3)	35 (50.7)		
Mothers with allergies	No (n=99) (%)	60 (87.0)	39 (56.5)	15.762	<0.001
	Yes (n=39) (%)	9 (13.0)	30 (43.5)		
Fathers with allergies	No (n=112) (%)	61 (88.4)	51 (73.9)	4.739	0.029
	Yes (n=26) (%)	8 (11.6)	18 (26.1)		

The history of parental allergy are important as an indicator to indicate the genetic risk faced by the offspring. Known as inheritable hypersensitivity, as early 1900, researcher determined that the heritability of allergy in overall was 48.4% of a group of 621 sensitized individuals with family history of sensitization to common environmental allergens, compared with only 14.5% of the control group of 76 non-sensitized individuals (Cooke and Vander Veer, 1916). Heritability of allergic disease is vary, but have been described as high as 95% for asthma, 91% for allergy rhinitis and 84% for atopic dermatitis (Ober & Yao, 2011).

Table 4 indicated the comparison of mean based on sociodemographic factors including gender and course of the respondents. Results shows that female student score higher in all Part although no statistically significant. Science course score significantly higher for part B ( $4.54 \pm 1.654$ ) compare with other courses. Post hoc Tukey analysis shows only TESL course obtain significantly lower score for part B compare to science students while other courses shows no significant difference although lower than science student. For part C, no significant differences were seen although science students had higher mean score compare to other courses. When comparing science stream (Science and Engineering) and Non-Science stream (TESL and Law) in term of scores, Science stream scored significantly higher compared to non-science stream in part B ( $P=0.006$ ), part C ( $P=0.038$ ) and part B and C ( $P=0.002$ ).

From the data, student with science background having higher awareness of allergy disease compared to the student without science background. This is because, the science student especially in biological course in the foundation program literally learned about allergy as their part of subject syllabus compared to engineering and another non-science courses. It also supported in previous study that student that formally exposed to the information that related to allergy such as medical students have sufficient knowledge about food allergy. However, some misconceptions such as high prevalence status of food allergy and food allergy can be treated do occur among them (Redhwan *et al.*, 2011). Comparison of mean between those having allergies and do not have allergies for all part showed no significant differences. The same was seen among those having allergies who consult health personnel and those who do not. This outcome also corresponded to previous study between allergy sufferer and non-allergy sufferer which indicate that allergy sufferer rated that allergy significantly give less overall impact on life (Lysons & Forde, 2004).

Table 4: Association between Sociodemographic factor and Public awareness

Variables	Score (mean ± S.D)						
		Part B (10 marks)	P	Part C (8 marks)	P	Part B and Part C (18 marks)	P
All Respondent (n=138)		4.33 ± 1.676		4.76 ± 1.421		9.11 ± 2.590	
Gender <sup>a</sup>	Male (n=23)	3.96 ± 2.225	0.36	4.30 ± 1.769	0.166	8.26 ± 3.583	0.201
	Female (n=115)	4.41 ± 1.544		4.86 ± 1.329		9.28 ± 2.320	
Course <sup>b</sup>	Science (n=108)	4.54 ± 1.654	0.024	4.92 ± 1.339	0.122	9.47 ± 2.427	0.015
	Engineering (n=15)	3.93 ± 1.534		4.13 ± 1.246		8.07 ± 2.463	
	TESL (n=7)	2.86 ± 1.952 <sup>c</sup>		4.14 ± 2.268		7.00 ± 3.830	
	Law (n=8)	3.63 ± 1.188		4.50 ± 1.690		8.13 ± 2.532	
Science Stream <sup>a</sup>	No (n=30)	3.60 ± 1.567	0.006	4.23 ± 1.591	0.038	7.83 ± 2.780	0.002
	Yes (n=108)	4.54 ± 1.654		4.92 ± 1.339		9.47 ± 2.427	
Have allergy <sup>a</sup>	No (n=58)	4.21 ± 1.673	0.452	4.57 ± 1.450	0.185	8.80 ± 2.746	0.249
	Yes (n=80)	4.43 ± 1.682		4.90 ± 1.393		9.33 ± 2.469	
Consult with health personnel <sup>a</sup>	No (n=51)	4.37 ± 1.732	0.714	4.73 ± 1.484	0.138	9.10 ± 2.715	0.278

As the case of allergy is common among this targeted population, increasing public awareness about the allergy symptom, treatment and prevention compromise a better future for allergy sufferer. The lack of awareness and knowledge on how to handle this susceptible population will increase the occurrence of food allergy reaction in future.

**Limitation of the study**

The data in this study was subjected to self-perceive method only without any clinical or laboratory test to confirm the diagnosis. This survey was conducted only based on the perceptive of the students, without any guidance by parents or physicians. The identification of the causal factors that trigger the allergy symptom also is a challenging task since it depends on numerous confounding factors and the cross-reactivity due to the diverge source of allergens. Other than that, the study sample may not represent all university students in the state of Selangor, however it does give general idea about the knowledge and awareness regarding food allergy among young adults.

## Conclusion

A continuous effort to increase knowledge and awareness about food allergy is essential in order to improve every aspect of life quality. Most young adults (age 18 and above) have started to live on their own. Hence, good understanding regarding allergy would help them to manage this disease by themselves without experiencing the worse symptoms such as anaphylaxis while away from their parents. Besides that, as young adults grow older, early revelation about allergy would be beneficial as they may become parents as well. Survey is the fastest method to access public knowledge about allergy and more studies likewise are required to be done in the future.

## References

1. American Academy of Allergy, Asthma and Immunology (AAAAI, 2017). Cross Reactivity of Allergy Reaction. Retrieve from <http://www.aaaai.org>
2. ASCIA.Food Allergy Clinical Update. 2016. Retrieved from [http://www.allergy.org.au/images/stories/pospapers/ASCIA\\_HP\\_Clinical\\_Update\\_Food\\_Allergy\\_2016\\_dietitian\\_version\\_UPDATED.pdf](http://www.allergy.org.au/images/stories/pospapers/ASCIA_HP_Clinical_Update_Food_Allergy_2016_dietitian_version_UPDATED.pdf)
3. ASCIA.Food Allergy Clinical Update. 2016. Retrieved from [http://www.allergy.org.au/images/stories/pospapers/ASCIA\\_HP\\_Clinical\\_Update\\_Food\\_Allergy\\_2016\\_dietitian\\_version\\_UPDATED.pdf](http://www.allergy.org.au/images/stories/pospapers/ASCIA_HP_Clinical_Update_Food_Allergy_2016_dietitian_version_UPDATED.pdf)
4. Caroline, J.L., Katrina, J.A., Adrian, J.L., Shyamali, C.D. Overview of Evidence in Prevention and Aetiology of Food Allergy. A review of Systematic Review. International Journal of Environmental Research and Public Health.. (2013) ISSN 1660-4610
5. Cezmi A, Hellings Peter W., Agache, I. Global atlas of allergic rhinitis and chronic rhinosinusitis. European Academy of Allergy and Clinical Immunology (2015) ISBN:9789612852061/9612852065
6. Chawes, B.I., Bonnelykke, K. & Kreiner-Moller, E. (2010) Children with allergic and non-allergic rhinitis have a similar risk of asthma. *J Allergy Clin Immunol.* 126:576-573.
7. Cooke RA, Vander Veer A. Human sensitisation. *J Immunol.* 1916;1:201–305. [Google Scholar]
8. Food Allergy and Anaphylaxis Network: education. advocacy.research. Awareness <http://www.foodallergy.org>.
9. Food Safety Authority of Ireland. Allergens. <http://www.fsai.ie> Accessed 20.04.2010.
10. Gendeh, B. S., Murad, S., Razi, A. M., Abdullah, N., Mohamed, A. S., & Kadir, K. A. (2000). Skin Prick Test Reactivity to Foods in Adult Malaysians with Rhinitis. *Otolaryngology–Head and Neck Surgery*, 122(5), 758–762. [https://doi.org/10.1016/S0194-5998\(00\)70211-7](https://doi.org/10.1016/S0194-5998(00)70211-7)
11. Hong, X., Tsai, H. J., & Wang, X. (2009). Genetics of food allergy. *Current opinion in pediatrics*, 21(6), 770–776.
12. Krugman, S.D., Chiamonte, D.R., Matsui, E.C.2006. Diagnosis and management of food-induced anaphylaxis: a national survey of pediatricians. *Pediatrics* 118(3):e554-560.
13. Kumar, Raj; Srivastava, Prakriti; Kumari, Dolly; Fakhr, Hena; Sridhara, S; Arora, Naveen; Gaur, S N; Singh, B P. (2007). Rice (*Oryza sativa*) allergy in rhinitis and asthma patients: a clinico-immunological study. *Immunobiology*, ISSN: 0171-2985, Vol: 212, Issue: 2, Page: 141-7. <http://10.1016/j.imbio.2006.11.006>
14. Liu, X., Beaty, T.H., Deindl, P., Huang, S.K., Lau, S., Sommerfeld, C., Fallin, M.D., Kao, W.H., Wahn, U. & Nickel, R. (2004). Associations between specific serum IgE response and 6 variants within the genes IL4, IL13, and IL4RA in German children: the German Multicenter Atopy Study. *J Allergy Clin Immunol.* 113(3):489-95.
15. Liu, X., Zhang, S., Tsai, H. J., Hong, X., Wang, B., Fang, Y., ... Wang, X. (2009). Genetic and environmental contributions to allergen sensitization in a Chinese twin study. *Clinical and experimental allergy : journal of the British Society for Allergy and Clinical Immunology*, 39(7), 991–998.
16. Lwanga, S.K. & Lemeshow, S. (1991). Sample size determination in health studies A practical manual. Retrieved from [http://whqlibdoc.who.int/publications/9241544058\\_\(p1-p22\).pdf](http://whqlibdoc.who.int/publications/9241544058_(p1-p22).pdf)



17. Lyons, A.C. & Forde, E.M. 2004. Food allergy in young adults: perceptions and psychological effects. *Journal of Health Psychology*, 9, (4) 497-504.
18. Madsen, C. 2005. Prevalence of food allergy: an overview. *Proc Nutr Soc* 64(4):413-417.
19. Malaysian Allergy Prevention (MAP) (2014). Guideline for Health Care and Professionals. Retrieved from <https://www.ogsm.org.my>
20. Margaret, M., & Faizal, A. (2015). Allergens derived from shrimp, 22(5), 1751–1754.
21. MOCHA: mothers of children having allergies <http://www.mochallergies.org>.
22. Muraro, A., Lemanske, R.F., Castells, M., Torres, M.J., Khan, D., Simon, H.U., Bindslev-Jensen, C., Burks, W., Poulsen, L.K., Sampson, H.A. and Worm, M., 2017. Precision Medicine in Allergic Disease—Food Allergy, Drug Allergy, and Anaphylaxis- PRACTALL document of the European Academy of Allergy and Clinical Immunology and the American Academy of Allergy, Asthma & Immunology. *Allergy*.
23. Murugappan, R. (2016, July 17). Managing Allergies. *The Star Malaysia*. Retrieved from <https://www.pressreader.com>
24. Ober, C and Yao, T.C., (2012). The Genetics of Asthma and Allergic Disease: A 21st Century Perspective, *Immunol Rev.* 2011 July; 242(1): 10–30. doi: 10.1111/j.1600-065X.2011.01029.x.
25. Ober, C., & Yao, T. C. (2011). The genetics of asthma and allergic disease: a 21st century perspective. *Immunological reviews*, 242(1), 10–30. doi:10.1111/j.1600-065X.2011.01029.x
26. Ober, C., & Yao, T. C. (2011). The genetics of asthma and allergic disease: a 21st century perspective. *Immunological reviews*, 242(1), 10–30.
27. Platts-Mills, T. E., Mitchell, E. B., Nock, P., Tovey, E., Moszoro, H., & Wilkins, S. (2003). Reduction of bronchial hyperreactivity during prolonged allergen avoidance. *The Lancet*, 320(8300), 675-678.
28. Portelli, M. A., Hodge, E., & Sayers, I. (2015). Genetic risk factors for the development of allergic disease identified by genome-wide association. *Clinical and experimental allergy : journal of the British Society for Allergy and Clinical Immunology*, 45(1), 21–31.
29. Redhwan, A. A., Low, W. Y., Mustafa, F. M., Robert, C., Ali, A. (2011). Perceptions about food allergy among medical science students in a university in Shah Alam , Selangor , Malaysia, 458, 451–458.
30. Robinson, J. M., & Ficca, M. (2012). Managing the student with severe food allergies. *The Journal of School Nursing*, 28(3), 187-194.
31. Robison R.G. Food allergy: diagnosis, management & emerging therapies. (2014) *Indian J Med Res.* 2014 Jun;139(6):805-13.
32. Ruby P; Stephen T. Holgate; G. Walter Canonica; Richard F. Lockey; Michael S. Blaiss . WAO White Book on Allergy (2013 Update). ISBN-13: 978-0-615-92916-3
33. Scadding, G.K. (2015). Optimal management of allergic rhinitis. *Archives of Diseases in Childhood*.100:576-582.
34. Sicherer, Scott H; Teuber, S. (2004) Adverse Reactions to Foods Committee. *The Journal of allergy and clinical immunology*, ISSN: 0091-6749, Vol: 114, Issue: 5, Page: 1146-50 .<https://doi.org/10.1016/j.jaci.2004.07.034>
35. Wan Mohammad, W. M., Nurul Y. K., Mohd Ashari, N.S., Sah, S., & Che Hussin, C. M. (2016). Food Allergen Sensitization among Malaysian Rhinitis Patients Food Allergen Sensitization among Malaysian Rhinitis Patients, (July).
36. Wong, G. W. K., Leung, T. F., & Ko, F. W. S. (2013). Changing Prevalence of Allergic Diseases in the Asia-Pacific Region, (July 2014). <https://doi.org/10.4168/aaair.2013.5.5.251>
37. Yadav, A. & Naidu, R. Clinical manifestation and sensitization of allergic children from Malaysia (2015). *Asia Pacific Allergy* 2015;5:78-83 <http://dx.doi.org/10.5415/apallergy.2015.5.2.78>
38. Yadav, M. (2009) Maternal Factor in Allergy. Retrieved from <http://www.allergycentre.com.my>
39. Zhafaran, N (2016, January 16). Society Bold Pledge. *The Star Online* Retrieved from <http://www.thestar.com.my>