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ADVERSE REACTIONS TO FOODS (ARFS) IN CHILDREN: PARENTAL KNOWLEDGE, AWARENESS AND BEHAVIOUR

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ABSTRACT

This study aimed to assess parental knowledge, awareness and behaviour on Adverse Reactions to Foods (ARF) and its relation to family's quality of life. In this cross-sectional study, 120 parents of children with documented ARFs in Selangor were recruited. Of these parents, 63.3% and 50.8% exhibited low levels of knowledge and awareness of ARFs, respectively. In terms of dietary practices, 31.7% avoided possible allergenic foods during pregnancy. The study found that 66.7% of children followed the childhood immunization schedule and 32.5% had symptomatic ARFs onset at age 36 months and above. Seafood appeared to be the main cause of ARFs (68%). ARFs appeared to be triggered mainly by environmental factors as reported by 46.7% of respondents. Nearly 56% of parents reported emotional responses associated with caring for ARF children while 8.8% and 17.5% found that ARFs affected relationships with family members and social acquaintances, respectively. A positive association was observed between specific levels of ARF knowledge and parental educational levels ($p < 0.05$). This findings represent an attempt to provide information for public education in a practical manner that can help optimize and sustain health benefits and overall community well-being.

Key words: Adverse Reactions to Foods (ARFs), children, parental knowledge, parental awareness, parental behaviour, sustainable livelihoods

INTRODUCTION

'Adverse Reactions to Foods' (ARFs) is a term that encompasses food intolerance and allergies that cause distressing symptoms and adversely affect the health of an individual (Mahan & Swift, 2012). Food allergies or hypersensitivities are adverse immune mediated reactions to foods containing certain compounds that elicit an immune response only when attached to a larger carrier protein. On the other hand, 'food intolerance' is an adverse reaction that does not involve the immune system. Food intolerance occurs due to the manner in which the body processes the food or a component of the food. It may involve a toxic, pharmacologic, metabolic, digestive, psychological or idiopathic reaction to a specific food type or chemical substance in the food. For example, a milk allergy elicits an adverse reaction by the body's immune system to a milk protein whereas milk intolerance is caused by the body's inability to digest lactose

due to impaired enzyme secretion (Mahan & Swift, 2012). Although there are differences in terminology and mechanisms of reactions that occur between food allergy and food intolerance, these terms are often used interchangeably.

In recent decades, the prevalence of food allergies, particularly to peanuts, has increased at alarming rates in the West (up to 2-fold) and affected more than 1% of the population by the early 2000s (Sicherer & Sampson, 2007). Studies found that approximately 8% of children less than 18 years of age have food allergies. This marked a significant increase from 3.9% reported in 2007 (Branum & Lukacs, 2008). Approximately six million children less the 18 years of age have food allergies in the U.S (Gupta *et al.*, 2011). Shellfish has been found to be one of the most common causes of food-induced anaphylaxis in several Asian populations, indicating that the patterns of ARFs may vary according to population (Thong *et al.*, 2007; Jirapongsananuruk *et al.*, 2008; Smit *et al.*, 2005; Goh *et al.*, 1999). According to the Malaysian Society of Allergy and Immunology (MSAI), in

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Malaysia, one out of three people are allergic to something, and if the trend continues, up to 50% of Malaysians will be allergic by the year 2020. However, the true incidence of food allergy is remained unknown (Gendeh *et al.*, 2000). Despite an increase in the prevalence of adverse reactions to food worldwide, there are very few population-based studies on food allergies in Asia (Lee *et al.*, 2008). The prolific peanut allergy epidemic among western populations suggests that the prevalence of peanut allergies in Asia is relatively low. However, this notion is not formally documented by any population-based study. Nevertheless, the high prevalence of food allergies reported in Asia may be due to the lack of differentiation between food allergies and food intolerance. The public is even less able to distinguish this difference in epidemiological terms.

Studies have shown that parents generally tend to overestimate the role of food as the cause of symptoms in their children, these diets are likely to be unwarranted as well (Merete *et al.*, 2001). A substantial number of parents perceived that their children have adverse reactions to food, but it is well documented that objective assessments agree with only one-quarter to one-half of parentally reported reactions (Eggesbù *et al.*, 1999). Approximately 30% of reported food allergies were not physician-diagnosed according to a study carried out by Gupta *et al.* (2013). This result is similar to that of Luccioli *et al.* (2008) in which nearly 34% of infants with probable food allergy as reported by the mother lacked a physician diagnosis. It is possible that, when a food allergy is suspected, parents may simply have their child avoid a specific food without consulting a physician. Although this may seem logical to a parent, it can be detrimental for the child (Gupta *et al.*, 2013).

The main purpose of this study is to determine level of knowledge, awareness among parents besides identifying the trends and prevalence of adverse reaction to food among children. By ascertaining levels of parental knowledge and awareness, as well as their perceptions regarding the importance of this knowledge, food allergen contamination measures can be better facilitated during food preparation. Together, with identifying knowledge of dietary intake and characteristics of children with food allergy or food intolerance, a more cautious approach by parents who deal with ARFs can be simplified. This study therefore contributes to the design of effective training or education programs for parents according to their degree of knowledge and awareness. In turn, this will enable greater confidence by providing more suitable approaches to caring for their children, and thereby enhance the family's overall health sustainability and wellbeing.

METHODS

The present study implemented a cross-sectional study in Selangor that involved 120 respondents to a self-administered questionnaire for data collection. Based on Yamane formula, given 95% confidence level, 0.05 precision level, considering at least 30% of the married couples in Malaysia have at least one child (total percentage of marriage in Malaysia is 59.9%), a total of 120 subjects were obtained. Purposive sampling was applied as this study only recruited parents with at least one child experiencing adverse food reactions. Sampling took place at the Hospital Serdang of Selangor, the Medical Center of University Malaya and Kuala Lumpur Hospital. This research was successfully registered with National Medical Research Registration (NMRR-14-1022-20755). The research proposal was also reviewed and approved by the Institute for Health and Behavioural Research (IHBR) for the Ministry of Health (MOH) and by the National Institute of Health (NIH). In addition, this study obtained ethical approval from the Medical Research and Ethics Committee (MREC). Targeted respondents were recruited from the paediatric departments of each medical centre cited above and only included parents with children (aged < 12 years) who had known adverse food reactions (through medical diagnose). Consent forms were signed by each respondent prior to the survey.

This study utilized an assisted self-administered Malay/English questionnaire as the research instrument. The questionnaire was divided into 6 sections as shown in Table 1. First section was the demographic profiles of the respondents including gender, age group, education background, marital status and number of children together with the number of children having adverse reaction towards food. Section 2(A) was to determine the knowledge of parents towards adverse reaction to food. There were 17 questions in this sub-section, with the first 5 questions aimed to determine the ability of parents to differentiate between food allergy and food intolerance. Besides that, there were 10 questions in this section to determine the parents' general knowledge regarding adverse reactions to foods, two questions to determine the knowledge of parents in handling emergency occasion of severe symptoms of adverse reaction to food. There were 12 questions in section 2(B), with the main purpose to determine the awareness towards adverse reactions to foods among parents which included the possible risk of developing systems of adverse reactions to foods, labeling information of possible allergen containing in processed and branded food as well as the sources for obtaining information about adverse reactions to foods. Section 3 consists of 13 questions, which were to determine the supplement consumption, food

Table 1. Contents, Purpose and Scales Used for Questionnaire

Section	Contents of Questions	Scales	References
Section 1: Demographic profile (6 questions)	Gender, age, educational background, marital status, number of children, number of ARFs children.	Nominal scale Ordinal scale	
Section 2(A) & (B): Awareness and Knowledge (29 questions)	Parents knowledge and awareness towards Adverse Reaction to Foods among children	Nominal scale	Malaysian Society of Allergy and Immunology (MSAI) (2011); Chin & Vickery (2012); Kumar <i>et al.</i> (2010).
Section 3: Behaviours of Parents, feeding practices, characteristics of ARFs children, major food groups and environmental factors (13 questions)	Subject's dietary intake and feeding practices. The several characteristics of ARFs children in terms of onset and current age, food allergen group, and effect of external factors	Nominal scale Interval scale	Sicherer <i>et al.</i> (2012); Joseph <i>et al.</i> (2011); Gupta <i>et al.</i> (2010).
Section 4: Effects of ARFs to the quality of life (10 questions)	The effects of ARFs to the quality of life of the family	Nominal scale	Choi (2012); Gupta <i>et al.</i> (2009); Jansson <i>et al.</i> (2013); Shek <i>et al.</i> (2010).
Section 5: Parents perception (8 questions)	The subject's awareness towards ARFs	5-point likert scale	Estelle & Simons (2010)
Section 6: Practices during food preparation approaches (8 questions)	Parents' practices during food preparation when preparing food for ARFs children	Nominal scale	Koplin <i>et al.</i> (2013)

avoidance during pregnancy, and feeding practices given to children having adverse reactions to food. Besides that, this section also focused on the characteristics of children having adverse reactions to foods such as their onset age, weaning age, gender, category of food that react adversely to as well as the symptoms and possible contributing external factors such as extreme weather condition and physical activities. Section 4 was to identify the effects of adverse reaction to food in children upon the emotional status of parents, relationship with other family members and to evaluate social life and social event involvement of the family having children reacted adversely to food. Section 5 and section 6 consisted of 8 questions in each section which was designed to evaluate parents' perception towards the importance of knowledge regarding adverse reaction to food and the food choices and preparations practices of parents when preparing food for children having adverse reaction to foods.

A pilot study was also undertaken to test the reliability of the questionnaire's content. Inter-item consistency for each question was tested against Cronbach's alpha. The result obtained from factor analysis revealed that section of Effects of ARFs to

Quality of Life, Perceptions of Knowledge, Practices of food preparation had Cronbach's alpha value of more than 0.7 which indicate good reliability of the inter-items consistency of the questions. All data obtained were analysed by using the SPSS version 21.0 for Windows. Normality testing was affirmed by the Kolmogorov-Smirnov test and for inferential statistics, and cross-tabulation analysis was used to determine any association between two categorical variables. The Chi-square (χ^2) test was used on condition the expected count was less than 5 (<20%) with a minimum expected count more than 2. Otherwise, Fisher's Exact Test was applied (Pallant, 2010). For all results, $p < 0.05$ indicated a significant difference.

RESULTS AND DISCUSSION

Socio-demographic profile of respondents

Table 2 shows that out of 120 respondents, 90.8% were female and 9.2% were male. Most respondents (27.5%) ranged in age from 30 to 34 years. The majority of respondents had a secondary level of education (53.3%).

Table 2. Socio-demographic Profile of the respondents

Personal Background	Number of Respondents (n=120)	Percentages (%)
Gender		
Male	11	9.2
Female	109	90.8
Age (Years)		
18–24	4	3.3
25–29	8	6.7
30–34	33	27.5
35–39	25	20.8
40–44	16	13.3
45–49	14	11.7
50–54	14	11.7
55 and above	6	5.0
Educational Level		
Never attended school	2	1.7
Primary	7	5.8
Secondary	64	53.3
Diploma	17	14.2
Bachelor Degree	24	20.0
Master Degree	4	3.3
Others	2	1.7
Marital Status		
Married	116	96.7
Divorced / Widowed	4	3.3
Number of Children		
1 – 3	74	61.6
4 – 6	42	35.0
7 and above	4	3.4
Number of Children having ARFs		
1	101	84.2
2	16	13.3
3	2	1.7
4	1	0.8

Knowledge and awareness of ARFs

The median knowledge score was 47.0%. Only 0.8% of respondents had a high level of knowledge regarding ARFs while most respondents (63.3%) had a low level of knowledge. The reason for this trend remained vague. Sandra *et al.* (2013) proposed ongoing education for Paediatric Emergency Medicine (PEM) physicians regarding patients with anaphylaxis due to the underuse of epinephrine in the PEM setting. Even though a majority of PEM physicians had correctly reported using epinephrine for paediatric anaphylaxis, not all had used preferential epinephrine administration and many patients had been discharged after abbreviated warding.

The overall median score for awareness was 44.4% while 48.3% of respondents scored a moderate level of knowledge and 50.8% showed a low level of awareness. It was surprising to find so many parents with a low level of awareness

regarding possible risks for ARFs. A full 25% of respondents either did not know or were not sure that food allergy reactions could cause the death of their child. In addition, 60% of respondents were unaware that sharing water bottles between children at school held the risk of transmitting food allergens. Nevertheless, nearly 70% of respondents agreed that consuming a very small amount of allergen containing food was sufficient to trigger symptoms. They also agreed that ARFs could become more severe with repeated exposure.

As for awareness of risks for developing adverse reactions to foods, 58.3% of respondents recognized that asthma was an important factor. In terms of awareness of hand cleaning to remove food allergens after dealing with allergen containing foods, 35.0% of parents perceived that using hand sanitizing gels was not a good method of removing food allergens. However, 65% of parents mistakenly used them.

Sources of information for (ARFs)

Although more than half of respondents (52.5%) claimed it was easy to obtain knowledge and information regarding ARFs, 88.3% of respondents were not sure of where or how to obtain detailed information. Limited access to detailed information may therefore be a major reason for a low level of knowledge and awareness among parents. The three main sources reported by respondents for obtaining information on ARFs were physicians (21.5%), the internet (20.2%), and friends, relatives or colleagues (19.9%). These results indicated that the most frequently used source was the physician.

Parental behaviour and characteristics of children with ARFs

This study indicated that 65.8% of mothers consumed dietary supplements during pregnancy as prescribed by physicians. These supplements included folate, iron, multivitamins and calcium, which normally do not include vitamin D.

Food groups to be avoided as recommended are those that comprise major contributions to adverse reactions as previously reported by Sicherer (2011). These foods include dairy products, fish, shellfish, wheat, eggs, peanuts and other tree nuts. About 66% of parents reported that they did not avoid any foods from these groups during pregnancy while 31.7% of mothers avoided at least one type of listed food. These findings are consistent with a previous study by Hourihane *et al.* (2007) who reported that although 61% of mothers recalled hearing advice to avoid peanuts during pregnancy, only 3.5% of mothers actually stopped consuming peanuts while pregnant or when breastfeeding. There were no differences noted between high risk and low risk mothers in recalling this advice or on the levels of

peanut consumption before pregnancy or during breastfeeding.

Feeding practices for children with ARFs

This study revealed that 38.3% of mothers exclusively breastfed their children with ARFs but without specifying duration. Another 7.5% of parents exclusively formula fed their child while most parents (54.2%) used complementary feeding methods. Earlier limited studies on links between breastfeeding and allergenic disease have fuelled debates. Furthermore, bias, misclassification and other methodological issues have complicated both analyses and interpretations. Despite reports of allergic reactions to cow's milk having developed after hospital discharge of otherwise exclusively breastfed infants who received bovine milk formula during the first few days of life, controlled studies have not demonstrated an increased risk of food allergy in infants who were given formula or those who were breastfed for shorter durations or to lesser degrees (Venter *et al.*, 2009). The low rate of exclusive breast feeding observed by the present study is likely because mothers of ARF children are unable to obtain the full support of their spouse or other family members who might think that breast feeding is not important. The frustration caused by symptoms of ARFs among children may also affect parental decisions to breastfeed their children and cause them to seek complementary food sources.

Parental food choices and weaning of ARF children

When choosing food for their ARF children, 79.2% of parents reported reading food labels to identify ingredients. This precaution endorses the importance of incorporating allergen labelling of food as part of the Food Act and Food Regulation in Malaysia.

Results from this study found that most parents (70.0%) began feeding solid food to their ARF children between 6 to 12 months of age. The most commonly reported age for the onset of adverse food reactions was 36 months and above. This finding suggests that weaning children at 6 months and above does not guarantee prevention from the risk of ARFs. Avoidance of solid foods and cow's milk for at least 4 to 6 months in breastfed infants had been considered an effective allergy preventive measure (Prescott & Tang, 2005). However, Anne *et al.* (2006) found no association between the timing of solid food introduction and the increasing prevalence of food allergies.

The present study also found that 56.0% of children with ARFs were female. However, this result does not indicate a higher prevalence for either gender. Turner *et al.* (2014) reported no significant gender-related difference in age distribution for

food-induced anaphylaxis, suggesting that such influences are not gender specific. Similarly, Bedolla-Barajas *et al.* (2014) also suggested there was no significant difference in gender with regard to food hypersensitivity in the adult population.

Age of onset for ARFs and child immunizations

Reported ages of onset for ARFs were 36 months and above (32.5%); 24 to 30 months (19.2%); and 12 to 18 months (15.8%). Food allergy prevalence was similar for all age groups, which supports reports from previous studies (Jackson *et al.*, 2013).

Two-thirds (66.7%) of parents reported that their children had completed the full immunization schedule, which is meant to be compulsory for all children until age 15, as stated by the Childhood Immunization Guideline of Malaysia. Immunisations against diphtheria, tetanus, pertussis and polio have been associated with an increased risk of eczema and food allergies by age seven. However, immunisations have not been associated with the onset of other atopic diseases after age seven. After adjustments for all possible confounders, little evidence for associations between immunisation status and the late-onset of asthma or atopic diseases remained (Nakajima *et al.*, 2007).

Factors affecting the symptoms of ARFs

Symptoms affected by extreme weather or environmental conditions were reported by 46.7% of respondents. Climatic conditions can have a significant symptomatic association with atopic patients, especially those suffering from atopic dermatitis (Jenerowicz *et al.*, 2011). Only 16.7% of respondents reported that symptoms appeared to be related to physical activities, two hours either before or after food consumption. Although a study on anaphylaxis in Korea by Yang *et al.* (2008) showed that 13% of 138 reported cases were thought to be related to food-dependent exercise-induced anaphylaxis, only 2.9% were eventually attributed to exercise-induced anaphylaxis.

Major food groups causing ARFs and symptoms

Seafood was the most offending food reported in the present study (68.0%). This category included shellfish and fish, and was followed by eggs (9.0%) and milk (8.0%). These results are consistent with previous studies that also reported hypersensitivity to shellfish as the most commonly reported reaction in older children and adults in Asia. Chen *et al.*, (2012) reported that in most parts of Asia (China, Korea and a few South East Asian countries), allergic reactions to eggs predominated over cow's milk in children below five years of age. Moreover, there are food allergies that are uniquely found in

specific regions in South East Asia (Lee *et al.*, 2013). These include bird's nest as a common cause of anaphylaxis in Singapore (Thong *et al.*, 2007).

The present study found that skin rashes were the most commonly reported symptom (63.5%). Other symptoms included asthma, stomach upset, diarrhoea, flu-like symptoms and facial swelling after consuming specific foods. Previous studies suggested that symptoms most commonly associated with food hypersensitivity can be systemically divided into those associated with the gastrointestinal tract, the skin, the respiratory system, or 'other' symptoms (Skypala and Venter, 2009). Symptoms that follow the ingestion of a specific food may occur within minutes, hours or even days after digestion.

Effects of ARFs on the quality of life

In term of emotional status, more than half of respondents (63.0%) agreed that their child's adverse reaction to food affected their emotional status. In term of its effect on relationship among family member, majority did not think that ARFs affected their relationships with other family members (89.2%) or their marriage (93.3%); and 88.3% of respondents reported never having a conflict with their spouse over the matter. Nevertheless, Gupta *et al.* (2008) reported that ARFs did affect relationships of both immediate and extended family members. In terms of its effect on social life, 78.3% of parents reported that ARFs impacted their daily social life and 71.7% said they avoided gatherings or parties to protect their children from possible exposure to allergens. This is consistent with previous study done among 253 members of the U.S Food Allergy and Anaphylaxis Network having allergic children aged 5 to 18 years which reported that the activities undertaken as a family unit are limited by having a

food allergic child (Sicherer *et al.*, 2001). However, there were 87.5% of these parents did not give up their works of career just because their children having adverse reactions to foods and need extra attention or care. Besides, in a study done in Italy among children aged <12 years who had documented IgE-mediated food allergy found that prolonged exclusion diets and food avoidance, which may be unnecessary, among these ARF's children will further impact their quality of life (Indinnimeo *et al.*, 2013). Restriction imposed on the patients due to the diet had the largest negative impact on health related quality of life (HRQL). Both severity of the food allergy and the presence of concomitant allergic disorders had a profound impact on HRQL (Jansson *et al.*, 2013). Hence, although parents were not affected emotionally in terms of family relationship, their social life was somewhat affected.

Knowledge level and association with dietary practices

With respect to children with ARFs, this study found no association between the level of knowledge and a mother's food avoidance behaviour, either during pregnancy or feeding practices as shown in Table 3.

Most of the parents with low and moderate level of knowledge of ARFs was found to be not avoided possible allergen containing food during pregnant. Furthermore, it was also found that disregarding the level of knowledge of parents, there was no exclusively breast feeding practiced in the feeding of their ARFs children. This finding suggested that the level of knowledge of parents basically do not affect their dietary behaviour, as well as their feeding practices given for children.

Table 3. Association of Level of Knowledge with Dietary Behaviour during Pregnant and Feeding Practices

Level of Knowledge	Possible Allergen Containing Food Avoidance				Pearson Chi-square
	Yes		No		
	n	%	n	%	
Low	33	32.7	68	67.3	$\chi^2 = 0.299$
Moderate	5	26.3	14	73.7	P-value = 0.585a
Level of Knowledge	Feeding Practices for ARFs Children (Exclusively Breast Fed)				Pearson Chi-square
	Yes		No		
	n	%	n	%	
Low	39	38.6	62	61.4	$\chi^2 = 0.021$
Moderate	7	36.8	12	63.2	P-value = 0.884a

^aSignificant level, $p < 0.05$ by Chi-square.

CONCLUSION

The present study revealed that parental levels of knowledge and awareness of ARFs was low, indicating the needs for education and systematic public awareness program must be implemented. Since seafood contributed the most to adverse reaction, wise food selection is important for sustainable livelihoods that will affect children's quality of life. The major offending food groups contributing to ARFs were regional compared to prior literature reports that the prevalence of each group varied within districts and geographical regions. Protective effects from dietary restraints provided by parents and their feeding practices on the onset of ARFs remains debatable. Besides, this study did not specify the duration of breastfeeding for children having adverse reactions to foods that might be worth for further investigation to give a best recommendation to parents for the feeding of children. The actual quality of life as perceived by children having adverse reactions to foods was not studied in this study. This study's results represent an attempt to provide information for public education in a practical manner that can help optimize and sustain health benefits and overall community well-being.

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