

Parent-Reported Suspected Food-Related Reactions and Feeding Practices in Children: A Cross-Sectional Survey from a Tertiary Care Hospital

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Abstract

Food allergies are a global pediatric health concern; however, epidemiological insights from Pakistan remain limited. This survey assessed frequency, triggers, and management practices of suspected food allergies among children attending a local hospital. This hospital-based cross-sectional survey was conducted at the Department of Pediatrics, of a tertiary care hospital in Lahore, Pakistan. A total of 200 children aged ≤ 7 years with parent-reported, suspected food-related reactions were enrolled through convenience sampling after obtaining informed verbal consent from their parents or caregivers. Data were collected using a structured questionnaire, based on previously reported approaches. Parent-reported information regarding demographic characteristics, infant feeding practices, suspected food triggers, clinical manifestations, diagnostic approaches, and management practices was recorded and analysed descriptively. Parental history of allergy was reported for 1.5% of mothers and 4% of fathers. The most frequently reported suspected triggers were dairy (47%) and gluten-containing foods (42%). Reported suspected symptoms following suspected food intake were predominantly gastrointestinal along with behavioral disturbances. Allergen elimination was the primary management strategy reported by most parents. Animal-derived milk was consumed by 60.5% of children and many ingested ≥ 25 ounces daily. Early introduction of non-breast milk sources was commonly reported among suspected patients. A low frequency of parental allergic history was reported among studied cases. Public health initiatives focusing on parental awareness and standardized diagnostic or management strategies are warranted for suspected childhood food-allergy care. Importantly, owing to study design, all findings are descriptive and refer to parent-reported rather than clinically confirmed food allergies.

1. Introduction

Food allergies are an increasingly prevalent concern in pediatric health, especially among children under five years of age, and may lead to respiratory, gastrointestinal, dermatological, or behavioral complications. Consequently, the well-being and growth of children with suspected food allergies may be significantly affected. Food allergies are typically categorized as immune-mediated and non-immune-mediated responses. Among the

immune-mediated types, immunoglobulin E (IgE)-mediated responses are predominant and involve a hypersensitive immune response to food proteins such as gluten sensitivity. In contrast, non-immune-mediated reactions are often enzymatic disorders, such as lactose intolerance (Bartha *et al.*, 2024; Calvani *et al.*, 2020).

Common triggers frequently reported to cause suspected immune reactions include dairy products, eggs, fish, cereals, nuts, and soy. Although breast milk is generally safe, some

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infants have demonstrated allergic responses to maternal milk as well (Bartha *et al.*, 2024). Dairy allergies may present as IgE-mediated or non-IgE-mediated conditions, with symptoms ranging from gastroesophageal reflux, enterocolitis, skin eruptions and occasionally failure to thrive (Giannetti *et al.*, 2021). Gluten sensitivity is another significant concern; it is a T-cell-mediated immune response that affects the intestinal lining and impairs nutrient absorption (Singla *et al.*, 2024).

Food allergies are diagnosed through clinical history, physical examination, and special tests, which include skin prick testing, intradermal testing, chemiluminescence assays for IgE detection etc. (LaHood and Patil, 2019). Global research shows that food allergy prevalence has increased over two-fold in recent years. In United Kingdom, cases increased from 75 to 159 per 100,000 people between years 2008 and 2018 (Baseggio Conrado *et al.*, 2021). Across Europe, an overall prevalence of approximately 19.9% was reported (Spolidoro *et al.*, 2023). Worldwide, clinically diagnosed food allergies affect approximately 4.3% of the population, including 2.4% of children and 1.6% of adults.

In age-specific data, cow's milk and nuts were reported to be the major triggers of food allergies in young children (Bartha *et al.*, 2024). A family history of atopy has been identified as a notable risk factor in other studies, a finding strongly supported by the evidence from Australian and Japanese studies (Saito-Abe *et al.*, 2022). Antenatal influences such as maternal smoking, obesity, and restrictive diet patterns may also influence and alter fetal immune programming. Postnatally, gut dysbiosis, cesarean delivery, and early exposure to antibiotics may disrupt normal microbiota development, further predisposing children to suspected allergic conditions (Lee *et al.*, 2020; Lockett *et al.*, 2015).

Cultural food habits and eating patterns, along with the onset of early weaning practices, significantly influence allergen sensitization. The dual allergen exposure hypothesis suggests that initial exposure to allergens via cutaneous routes may predispose children to the development of suspected allergies. Oral exposure may promote immune tolerance (Lack, 2008; Brough *et al.*, 2020). This may result in tolerance to various foods, with suspected allergies often resolving substantially during early childhood.

Although, there is an increasing recognition of food-based allergy as pediatric health concern, the data from Pakistan is

insufficient to describe the commonly reported food-triggers, clinical manifestations, diagnostic approaches, and dietary management practices in young children. A study conducted in Rawalpindi and Islamabad by Inam *et al.* (2016) showed that approximately 35% of the children with suspected allergies were sensitized to food allergens. A similar pattern was observed in another national survey, which also highlighted the need for local allergy screening and public health education (Sharif *et al.*, 2021). However, systematic data on pediatric food allergies in Pakistan remain scarce. Therefore, this survey aims to fill the gap by investigating the parent-reported suspected food-allergy frequency, associated demographics, caregiver awareness, and symptomatology of food allergies among children in Lahore, Pakistan. Given the global rise in pediatric food allergies, it is crucial to gather descriptive data from underrepresented regions.

2. Material and Methods

This is a cross-sectional questionnaire-based survey, conducted in the Pediatrics Department of a tertiary care hospital in Lahore, Pakistan. Data were collected over a period of six months. Children of either sex, from birth up to and including seven years of age were eligible for the study. Children presenting with infections, congenital anomalies, genetic disorders, or those aged seven years old or older were excluded from participation. A total of 200 children were enrolled via convenience sampling, based on their availability during the study period. This method was considered suitable because cases of suspected pediatric food allergies are frequently identified during medical appointments and hospital admissions, and there is no centralized database of parent-reported suspected cases in Pakistan. Moreover, randomized sampling was not feasible within the study setting and recruitment period.

A structured questionnaire was used to assess the frequency of suspected food-related allergies, including variables related to demographic characteristics, pregnancy history, family history of allergies, age at first reported reaction, specific food allergens, clinical symptoms, and management practices. The questionnaire was basically based on previously reported approaches, and the parent/caregiver responses were recorded according to the pre-defined categories provided in it (Inam *et al.*, 2016; Golzar *et al.*, 2022). Informed verbal consent was obtained from all participants before data collection. The study was approved by the institutional ethics committee. Suspected food allergy

cases were defined as parent-reported adverse reactions following ingestion of a specific food, consistent with the approaches used in previous survey studies (Boyce *et al.*, 2010; Muraro *et al.*, 2014). No independent clinical or diagnostic confirmation of suspected food allergy was performed within the scope of this survey. However, in some cases the parent-reported findings were supported by clinical history together with laboratory evidence, including serum Immunoglobulin E (IgE) testing and/or skin-prick testing, as part of their clinical evaluations prior to this study.

Statistical analysis was performed using SPSS version 16 (IBM, Armonk, New York, USA). As the study design was primarily exploratory and cross-sectional in nature, descriptive statistics were used to present parent-reported frequencies. The formal tests for associations and correlations were not performed. The parent-reported frequency (%) was calculated by using the given formula (Eq. 1) (Fletcher *et al.*, 2012).

$$P = y/n \times 100$$

Where y represents the number of people having a condition at a particular time and n is the total number of people in the study population.

3. Results and Discussion

3.1. Results

The questionnaire-based data were obtained from the parents of 200 children under seven years of age attending the Pediatrics Department of a local Hospital in Lahore, Pakistan. The findings are based on parent-reported information regarding suspected food-based allergies and associated practices, in the studied population.

Mothers were the primary respondents in most cases (90%), while fathers and other related family members contributed 1% and 9% respectively. The distribution of cases was nearly equal between genders (49.5% males and 50.5% females). Children aged 2 to 3 years accounted for the highest proportion of parent-reported food allergy complaints (34%). More cases were reported from urban areas (57%) compared with peri-urban areas (43%). Most children (73.5%) were reported to have been born in healthcare facilities. Parental history of suspected food-related allergies was uncommon, reported in 1.5% of mothers and 4% of fathers. Parents reported adequate early nutritional status in the majority of children, with 85% being appropriately fed in the first month and 74.5% achieving satisfactory weight gain.

Table 1. Parent-reported allergic symptoms after food consumption.

Category	Problem/Symptoms	Frequency (%)
Behavioral	Mood swings	97
	Aggression	3
Skin	Rashes	57
	Facial/neck swelling	4
	Eczema	19
	Soreness at lips	6
	Redness of skin	14
Gastrointestinal	Gastroenteritis	76
	Vomiting	9
	Constipation	4
	Stomach cramps	9
	Gas	1
	Itching in mouth	1

Frequency was calculated separately for each parent-reported symptom category. These symptoms are nonspecific and should not be interpreted individually as evidence of clinically confirmed food allergies.

Regarding feeding practices reported by parents, 60.5% of the children received animal-derived milk (cow, buffalo, or goat), while 25% consumed formula milk containing animal protein. Breastfeeding was reported in 10% of children. Fewer children were reported to consume tetra pack milk (2%) or plant-protein-based formula milk (2.5%). Daily milk intake, as reported by parents, was between 25 to 35 ounces (0.7–1.0 L) in 44.5% of the children, while 27.5% consumed more than 35 ounces (1 L). Overall, 85.5% of children with parent-reported suspected symptoms received animal-derived milk or formula milk at a very early stage of life. This observation only describes the reported feeding pattern of the study population and should not be used to establish a causal relationship with suspected food-related reactions.

Following weaning, the most frequent parent-reported dietary triggers of suspected allergic reactions were dairy foods (47%) and gluten-based products (42%). Other less frequent suspected triggers included oils and fats, eggs, antibiotics, and processed foods (Figure 1.). Parent-reported symptoms appearing after consumption of suspected allergenic foods were predominantly gastrointestinal and dermatological in nature (Table 1.) These symptoms were merely parent-reported observations and should *not* be

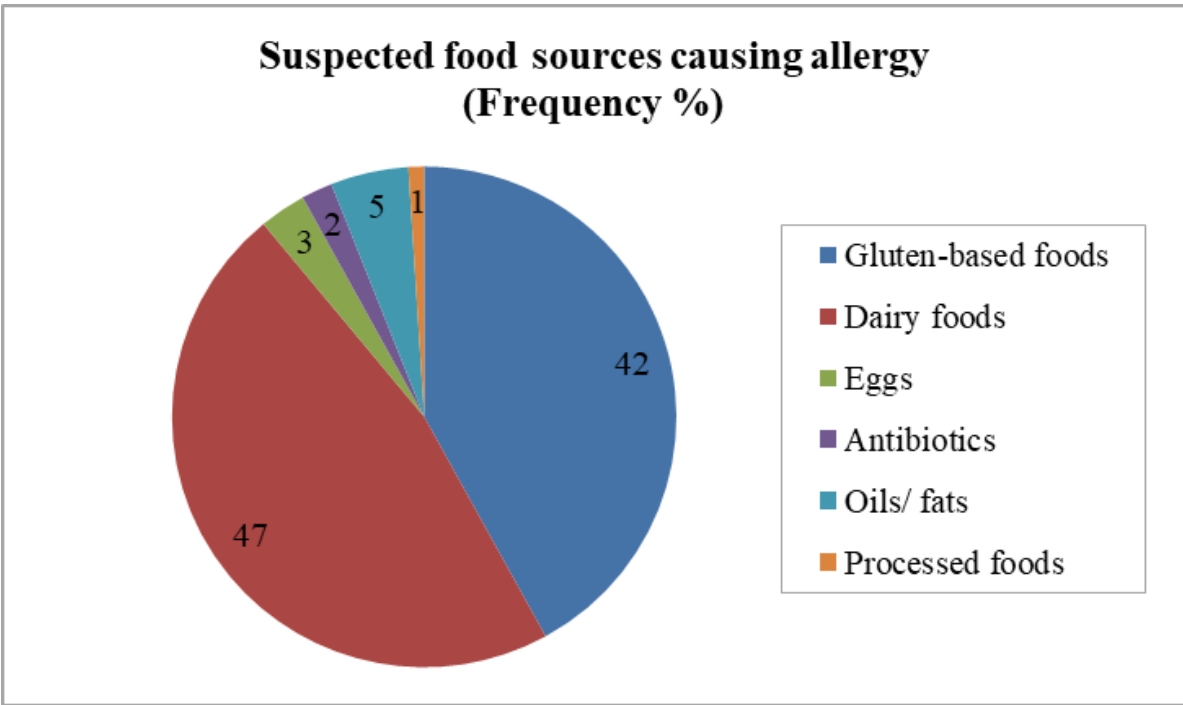


Figure 1. Food sources involved in parent-reported allergic responses in children with suspected allergies.

considered as clinically confirmed food allergy symptoms. Parents also reported information on clinical diagnostic practices. Clinical history was the most reported diagnostic approach (50%) followed by IgE blood (40%), serum electrolyte testing (9.5%) and skin prick testing (0.5%) (Figure 2.).

In terms of management, 79% of the parents reported complete avoidance of the suspected allergenic food from their child’s diet. Occasional intake was reported in 10% of the suspected cases, while 9% continued consumption in small portions. Substitution with alternatives was reported in 1% of cases, while the remaining 1% reported no dietary modifications (Figure 3.). Overall, this parent-reported cross-sectional survey describes patterns of early dietary exposure, particularly to animal-derived milk, alongside parent-reported gastrointestinal and dermatological symptoms. No causal conclusions can be drawn. External environmental and dietary factors may contribute to shaping parent-reported suspected-allergy patterns in the studied population.

3.2. Discussion

Suspected pediatric food allergy is a growing global health concern and has gained significant clinical attention owing to its increasing prevalence and challenges. Reported data

on suspected food allergies whether parent-reported or clinically confirmed vary widely. The global estimates indicate that pediatric food allergy affects up to 10% of the children (Loh and Tang, 2018). In this context, hospital-based studies from underrepresented regions such as South Asia are essential for interpreting global estimates, as data from these settings remain limited. The present study contributes to this limited body of evidence by examining parent-reported suspected food-related reactions in a pediatric population from Lahore. These insights are relevant not only locally but also to other resource-constrained and transitional settings worldwide. In this questionnaire-based cross-sectional study, parent-reported data were obtained from 200 children aged ≤ 7 years. Children from urban areas were reported to have higher frequency of suspected food-based allergies (57%) than those from peri-urban areas (43%). A similar pattern has been described in the studies from United States of America, where urban children had higher prevalence of food allergies (9.8%) than those from the rural areas (6.2%) (McGowan *et al.*, 2015; Gupta *et al.*, 2012). Minimal differences in the frequency of suspected food allergies were reported between genders (49.5% males and 50.5% females). This contrasts with some regional studies

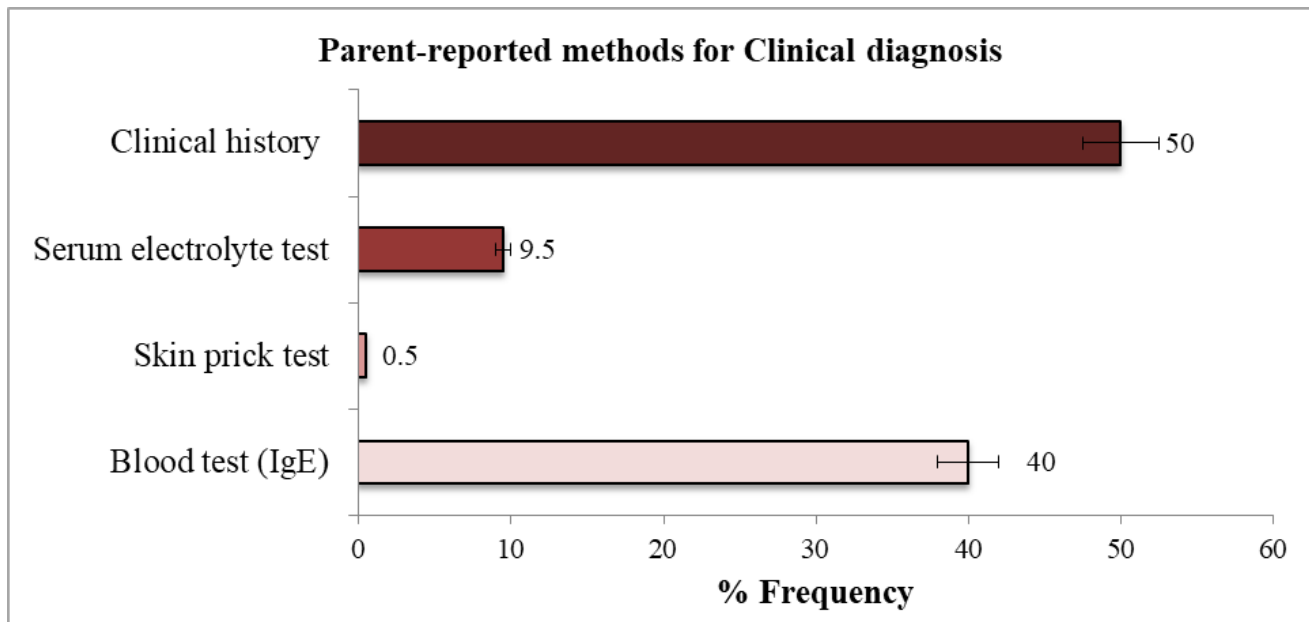


Figure 2. Diagnostic strategies utilized for suspected pediatric food allergy, reported by parents.

reporting higher sensitization among males (72.8%) compared to females (27.2%) (Hussain *et al.*, 2019). Another study from Saudi Arabia reported slightly higher rates of food allergy in females (52%) than in males (48%), similar to our parent-reported findings (Alibrahim *et al.*, 2024). Maternal involvement (90%) as primary caregivers was a notable finding, more so than fathers or other family members. This observation aligns with international literature and underscores the role of caregivers as key stakeholders in the prevention and management of prevalent allergies (Chooniedass *et al.*, 2020; Moen *et al.*, 2019). This underscores the importance of caregiver-focused education and awareness strategies, which may be associated with improved outcomes for children with parent-reported suspected food allergy in the current setting.

With the highest frequency of suspected food allergies occurring between the ages of one and three years (34%), the age distribution observed in this parent-reported study is consistent with global trends reported in population-based studies from Australia, Europe, and North America (Peters *et al.*, 2017). Moreover, dairy and gluten-containing foods were reported by parents to be the predominant suspected food allergens in children under seven years of age. The majority of parent-reported suspected allergic manifestations were gastrointestinal and dermatological. However, in the absence of standardized clinical

confirmation, the reported symptoms cannot establish an immunologically triggered food allergy. Similar trends have been described in international literature, although the specific types of food triggers vary across populations (Giannetti *et al.*, 2021; Singla *et al.*, 2024). The similarity of age-related patterns across diverse geographic regions is consistent with the concept that early-life exposure to allergens may be associated with food allergy development (Lockett *et al.*, 2015; Lack, 2008).

Since milk is the primary source of nourishment for children in early life, the feeding practices recorded in this parent-reported study indicate that approximately 90% of children received animal-derived milk or formula milk at a very early stage of life. Such feeding patterns have also been documented in existing literature of other low- and middle-income settings, which identify cow's milk proteins and gluten as the most allergens in pediatric populations (Loh and Tang, 2018). In a systematic review published in Europe between 2000 and 2012 (Spolidoro *et al.*, 2023), the most common food allergen was cow's milk (1.3%), compared to shellfish, eggs, grains, and legumes, which is like our reported feeding pattern. In contrast, in Saudi Arabia egg allergies are most prevalent among young children (Alibrahim *et al.*, 2024). In another meta-analysis, food allergy prevalence among young children and adolescents in China ranged from 3.2% in Beijing to 8%

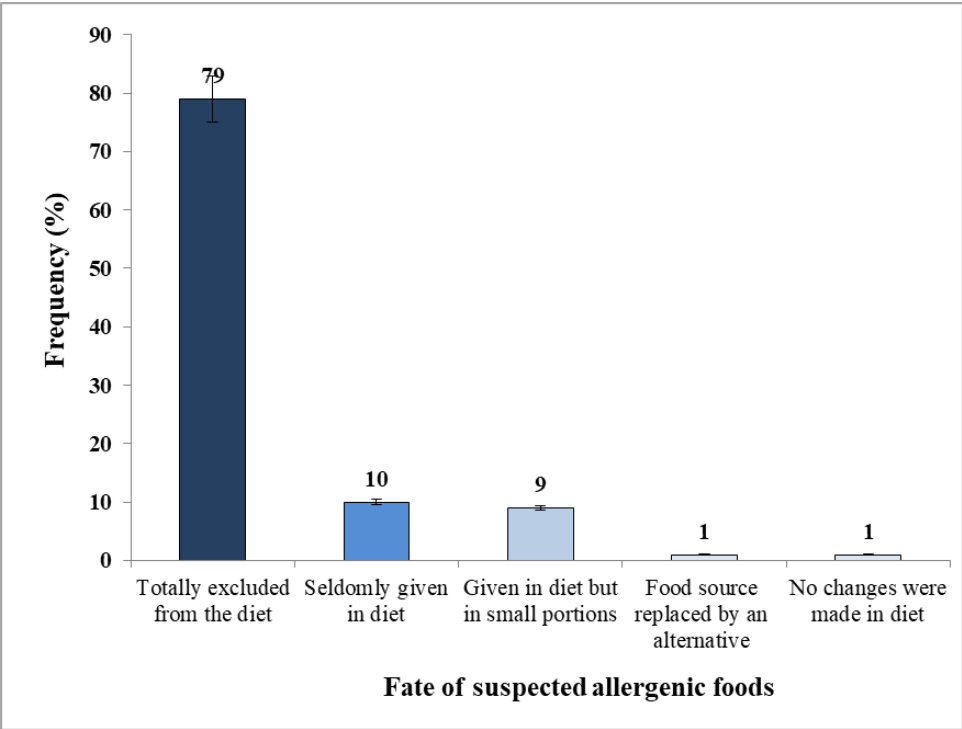


Figure 3. Fate of suspected allergenic foods in children with parent-reported food allergy.

nationwide. The most common allergens in China included milk, eggs, fruits, and seafood, with crab and shellfish being more prevalent in the Chinese population than in Western populations. Symptoms are predominantly skin-related (Longo *et al.*, 2013; Fleischer *et al.*, 2012). Nationwide data from Korean school children indicated a 4.06% prevalence of immediate-type food allergy, with 0.97% experiencing food-induced anaphylaxis. Common allergens included peanuts, milk, eggs, fruits, crustaceans, and tree nuts. In early childhood, prevalence is 3.7%, which is higher among younger children, with hen's egg, milk, and peanuts reported as leading identified allergens (Sha *et al.*, 2019; Luo *et al.*, 2022). Another parent-reported study suggested that approximately 8% of U.S. children have food allergies, although more than 11% are perceived as food allergic. Leading allergens included peanuts, milk, shellfish, and tree nuts, and nearly half of the affected children reported severe reactions. CDC data show that 3.4% of children (ages 0-21 years) were diagnosed with food allergies, with a median age of 8 years. Racial disparities also existed, with African American (Black) children experiencing higher rates (37.7%) than patients of other races (Hispanic and multiracial) (Taylor-Black and Wang,

2012). Dietary differences across countries, including food consumption patterns, preparation methods, and the age of introduction of allergenic foods, may contribute to these variations (Loh and Tang, 2018). Gluten (wheat) was predicted as the second most frequent suspected food trigger (42%) by parents in the present study population. In contrast, this suspected trigger is ranked as the third most prevalent food allergen in Germany, Japan, Finland and the USA, with cows' milk allergy and egg allergy being the first and second major causes (Gupta *et al.*, 2018; Zablotzky *et al.*, 2023). Collectively, the predominance of cow's milk consumption represents an observed feeding pattern associated with the development of suspected food-related reactions within the study population. However, due to the cross-sectional design and parent-reported nature of this study, the reported findings cannot establish whether the timing or type of milk feeding really contributed to the reported suspected food-related reactions. Nevertheless, cow's milk was among the most frequently reported suspected food trigger in early childhood across Europe, East Asia, and North America which is broadly consistent with our study (Giannetti *et al.*, 2021; Spolidoro *et al.*, 2023; Longo *et al.*, 2013; Fleischer *et*

al., 2012; Taylor-Black and Wang, 2012; Gupta *et al.*, 2018). Similarly, wheat and gluten-containing foods are among the most commonly reported food allergens globally, particularly in populations where cereal-based complementary feeding is introduced early (Singla *et al.*, 2024; Loh and Tang, 2018; Gupta *et al.*, 2018; Zablotsky *et al.*, 2023). Major symptoms after ingesting suspected food allergens were related to gastrointestinal upset, skin reactions and mood changes as reported by the parents, in this study. These observations may resemble previously reported clinical features of IgE-mediated food allergy however; no causal relationship can be established from the present study (Turnbull *et al.*, 2015).

Information regarding diagnostic practices for suspected food allergy, as indicated by parents, showed reliance on clinical history. There was limited reporting of confirmatory investigations such as serum IgE and skin prick testing, which is consistent with reports from other resource-constrained settings (LaHood and Patil, 2019; Sharif *et al.*, 2021; Loh and Tang, 2018). The limited use of standardized diagnostic testing reported by parents may increase the risk of misclassification and potential overestimation of disease burden (LaHood and Patil, 2019). This limited application of confirmatory testing highlights the need to implement cost-effective testing tools in resource-limited settings. Conversely, skin prick testing has been reportedly used to detect target antigens of IgE-mediated allergic reactions caused by beef, mutton, chicken, egg, fish and rice-based allergens in some studies conducted in Islamabad, Pakistan (Hussain *et al.*, 2019; Munir *et al.*, 2022).

The management strategies reported by the parents were largely supportive and mainly focused on symptom control. Most parents in this study (79%) followed strict avoidance of the suspected food trigger for their children. Limited use of hypoallergenic substitutes or alternative nutritional sources was noted. A properly managed, well-balanced elimination diet may help resolve symptoms while maintaining nutritional status (Sicherer and Sampson, 2010). In 1% of parent-reported children, suspected allergenic foods were substituted with suitable alternatives to avoid nutritional deficiencies that could affect optimal growth. Although the nutritional status was not assessed, the reported observations from the present survey highlight the need of appropriate dietary guidance and nutritional substitution when food elimination is considered. The

widespread adoption of elimination diets without adequate dietary substitution may raise nutritional concerns that extend beyond Pakistan. The limited availability and high cost of hypoallergenic formulas or fortified alternatives have been previously associated with an increased risk of nutrient deficiencies among children with suspected food allergies (Calvani *et al.*, 2020; Giannetti *et al.*, 2021; Loh and Tang, 2018; Sicherer and Sampson, 2010). Early introduction of animal derived milk during infancy is a trend seen in urbanizing, low- to middle-income countries (Loh and Tang, 2018). The use of animal-based or formula based milk, which represents a shift away from exclusive breastfeeding, has been associated with altered immune development and increased susceptibility to allergic disease in other studies (Lee *et al.*, 2020; Lack, 2008). Global recommendations emphasize the importance of optimal feeding practices as essential for preventing food allergies. Optimal feeding practices should be integrated with nutrition-sensitive policies, ensuring their affordability along with caregiver counseling (Loh and Tang, 2018; Sicherer and Sampson, 2010).

The burden of pediatric food allergies and their management vary regionally and internationally. Cross-national comparisons may therefore provide useful context. Overall, this study provides descriptive insights into parent-reported suspected food-related reactions in a pediatric population. The principal strength of this parent-reported survey is the heterogeneous sample, comprising children of both genders and from both urban and peri-urban areas. This may enhance the understanding of the timing of symptom recognition and the context in which suspected food allergies are identified, and by whom. These parent-reported findings suggest the need to strengthen public awareness and nutritional policies that may help to reduce potential allergy-related morbidity. The findings emphasize the need for improved caregiver awareness, access to standardized diagnostic evaluation, and context-specific nutritional guidance. However, interpretation of the findings should remain cautious, as they are based on parent-reported data without uniform clinical confirmation.

This study has several limitations including lack of formal questionnaire validation. Since this is a parent-reported survey, findings are based on parent-reported symptoms without uniform clinical or diagnostic confirmation, so both overestimation and underestimation of true clinical food allergy are possible. The use of a convenience sampling

rather than a randomized approach further restricts the generalizability of the findings, as the study population was drawn from a single tertiary care hospital. This may contribute to selection bias and overrepresentation of suspected cases. Therefore, reported frequencies should be interpreted as reflecting a hospital-attending pediatric population rather than true community-level prevalence. These limitations should be considered when interpreting the results. Clinical measures to determine the accuracy of suspected food allergies require additional funding.

Future studies should include a larger and more diverse pediatric population by incorporating multiple cities across the country to provide a more accurate estimate of the national frequency and greater insight into patterns of suspected food allergies in children. Moreover, appropriate sample sizes should formally test associations between feeding practices, demographic factors, and suspected allergic reactions to identify independent triggers. Further evaluation of the overall impact of suspected food allergies, including regional and cultural dietary habits, environmental exposures, healthcare access, the quality of life of affected families and the economic burden, will eventually help to develop better public health strategies and ultimately promote the well-being of children living with suspected food allergies in Pakistan.

Conclusion

In conclusion, this parent-reported study predicts patterns of suspected food allergies and associated factors among younger children attending a tertiary care hospital in Lahore. The findings suggest associations between early-life dietary exposures and parent-reported food allergy symptoms, though causality cannot be established. This study highlights the importance of improving standardized diagnostic protocols for suspected food allergies and strengthening public health awareness to facilitate early detection and better management. Caregiver education is also essential for optimizing long-term health outcomes for children with suspected food allergies in Pakistan. However, these findings are descriptive and based on parent reports without clinical confirmation and, therefore, should not be interpreted as estimates of clinically confirmed food allergy prevalence.

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Ethical Approval:

Ethical approval for this study was provided by Punjab University; Institutional Ethics Review Board vide protocol number: D/165/FIMS respectively.

Authors contribution:

Study conception and design: BM, FJT; data collection: HB; analysis and interpretation of results: BM, FJT, HB; draft manuscript preparation: ZA, BM, FJT. All authors reviewed the results and approved the final version of the article.

Conflicts of Interest

The authors declare that there is no conflict of interest to disclose.

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