Vol. 5 No. 1 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Association of Daily Life Activity with Nutritional Status among Children with Food Allergy

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Keywords: Food Hypersensitivity, Nutritional Status, Activities of Daily Living, Paediatrics, Quality of Life, Cross-Sectional Studies, Growth Charts, Diet Therapy.

Received on 20 Feb 2026
Accepted on 16 Mar 2026
Published on 26 Mar 2026

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Abstract

Introduction:
Food allergy contributes to the avoidance of essential dietary items in children, potentially leading to nutritional deficiencies, as many allergenic foods are rich sources of vital nutrients. Common allergens include cow's milk, fish, eggs, wheat, peanuts, soy, and tree nuts. Beyond dietary restrictions, food allergies can impact several domains of a child's daily life including meal preparation, social and school activities, family relations, and financial burden. These lifestyle disruptions may contribute to compromised nutritional status. This study aimed to explore the association between daily life activity and nutritional status among children with food allergy.

Objective:
To assess the association between daily life activity and nutritional status among children with food allergy.

Methodology:
This cross-sectional study included 253 children with diagnosed food allergies. A structured questionnaire was used to collect data related to demographic and allergy-specific characteristics. Nutritional status was assessed using the Centers for Disease Control and Prevention (CDC) growth charts. The impact on daily life activities

was evaluated using the Food Allergy Impact Scale. Data were analysed using IBM SPSS Statistics version 23.0. The Chi-square test was applied to determine the association between nutritional status and daily life impact scores.

Results:

The mean age of participants was 8.82 years. The mean weight was 24.50 kg, and the mean height was 46 inches. Of the total participants, 119 were male and 134 were female. Out of all participants, varying forms of malnutrition were observed, including stunting, wasting, underweight/overweight, and combined forms of malnutrition, while a small proportion had no nutritional impairment. Regarding the Food Allergy Impact Scale (FAIS), 229 participants had a non-significant impact, whereas 24 showed a significant impact. There was no significant association between nutritional status categories and FAIS ($\chi^2 = 1.888$, $p = 0.864$).

Conclusion:

No significant association was found between daily life activity and nutritional status among children with food allergy.

Introduction

Food allergies occur in about 6- 8 percent of children in the initial years of life, which is a critical age when a child should grow and develop. Most of these allergies are brought about by a select number of foods including cow milk, eggs, peanuts, tree nuts, soy, wheat, and fish. More than eight out of ten affected children have allergies only with one or two of them (1). These are foods that are known to form major ingredients of the child diet and are made up of very crucial nutrients (2).

Exclusion of allergen foods either through established diagnosis or through precautionary exclusion may result in nutritional deficits and infections to growth (1). WHO and CDC growth charts define stunting as a consequence of poor nutritional intake in children with food allergies (wasting or malnutrition) (3). Besides the nutritional issues, children with food allergies tend to face the restriction of their everyday activities based on the fear of being exposed to it and become restricted in social activity, education, and athleticism (4,5).

Food allergies refers to harmful immunological responses against food antigens, and it includes mild presented skin symptoms or gastrointestinal manifestations, and life threatening anaphylaxis (6,7). Diagnosis is carried out usually through history, specific IgE, skin prick tests, and oral food tests (8). Irrespective of the increased level of the means to diagnosis, nowadays, there are no FDA-approved food allergy treatments, and the management aims at the management of food allergy through strict dietary avoidance and the preparation of emergency necessary responses.

The psychological and financial toll to families is huge. There is complexity in the preparation of the food, social occasions might be skipped and the children might also be anxious along with a poor quality of life (9,10). The food allergies observed in children vary across the world with clinically proven food allergies estimated to be between 1-10 percent based on the age and the regions (11,12). A local study in Karachi gave significant reactions to the egg, milk and soybean in children (13).

Although the burden of the condition is increasing globally and regionally, the association between the nutritional and activity level in food-allergic children has gained minimal attention (14,15). This study aims to assess the association between daily life activities and nutritional status among children with food allergies.

Material & Methods:

The cross-sectional study was based within a 6 months framework (December 1, 2022 March 31, 2023) throughout several hospitals within Lahore, such as the Children Hospital, Sheikh Zayed Hospital, Punjab Rangers Hospital, Fauji Foundation, and General Hospital. The article sought to evaluate the relationship between everyday life activities and nutritional status of children aged between 6 years and 12 years who

had physician-diagnosed food allergies (4). Children were included provided they were confirmed by a doctor of food allergy or food allergen test, which may include skin prick test and at least one year. A purposive sampling method was carried out to sample 253 participants. Children with thyroid disease, enteral or parenteral-feed dependent children, and those children undergoing processes known to influence the nutrient metabolism or iodine status were excluded in the research (9).

The results were obtained using structured questionnaires that were done by mothers of the involved children after obtaining the ethical approval. The nutritional status and activity in daily life were used as two variables. CDC Growth Charts were used to measure nutritional status which include: categorization of children by percentiles in terms of their ages and gender, such as: stunted (height-for-age <5th percentile), wasted(weight-for-height <5th percentile), underweight (weight-for-age <5th percentile), overweight (those in the range of 85-95th percentile) and obese (those in the range of 95th percentile) (4).

The Food Allergy Impact Scale (FAIS) was used to measure daily life activity and consisted of 27 items with eight domains including meal preparation, family social activities, caregiver-supervised child social activities, family relations, caregiver stress and free time, school or structured child activities, autonomous child social activities, and employment and finances. Individual items referred to an activity or interaction and scored by parents using a 7-point Likert scale with a score equal to or greater than 5 depicting a significant effect of food allergy on that activity (4). A mean perceived impact score was then calculated for 8 content domains of the scale: meal preparation, family social activities, family relations, parental stress and free time, finances and employment, school or structured child activities, caregiver-supervised child social activities, and autonomous child social activities. The FAIS indicated satisfactory internal consistency, and results of Cronbach alfa were as follows: meal preparation (alpha = 0.96), family social activities (alpha = 0.88), caregiver-supervised child social activities (alpha = 0.73), family relations (alpha = 0.79), caregiver stress and free time (alpha = 0.80), school of structured child activities (alpha = 0.86), autonomous child social activities (alpha = 0.55), and employment finances (alpha = 0.6) (9)

The data were analysed statistically by means of the IBM SPSS Statistics version 23.0. Descriptive data were presented in means, medians, standard deviations and frequencies. The use of chi-square tests helped to study correlations between nutritional status, FAIS scores, and characteristics of the participants. A p value of below 0.05 was to be taken seriously.

Results:

The demographic profile of the 253 participants showed a slightly higher proportion of males (53.0%) than females (47.0%). The children had a mean age of 8.82 years (±1.98), with an average weight of 24.51 kg (±8.37) and an average height of 46.19 inches (±5.00). Nearly half of the participants (46.6%) reported no family history of food allergies, while others indicated hereditary links, primarily through the mother (21.7%) or father (14.2%). Most fathers were educated up to high school (30.8%) or bachelor's level (40.7%), while a smaller percentage were uneducated (6.7%). Similarly, 35.2% of mothers held a bachelor's degree, whereas 11.9% were uneducated. Regarding nutritional status, a substantial proportion of children exhibited stunting (35.8%), wasting (10.0%), or were underweight/overweight (13.1%), while 21.8% presented with any two forms of malnutrition and 12.7% had all forms of malnutrition; only 6.6% of participants had no nutritional impairment. The most frequently affected organs due to allergies included multiple organ systems (50.99%), followed by the skin (21.74%) and gastrointestinal tract (18.58%). Dairy products, including milk and eggs, were the most commonly reported allergens (30.83%), followed by wheat (21.34%), nuts (15.02%), and fish or shellfish (13.83%).

A small proportion of children (2.37%) were allergic to multiple food groups. (Table 1)

Table 1. Demographic Characteristics of Participants (n = 253)

Variable	Category	Frequency (%)
Categorical Variables		
Gender	Male	134 (53.0%)
	Female	119 (47.0%)
Genetic Tendency	Father	36 (14.2%)
	Mother	55 (21.7%)
	Both Parents	26 (10.3%)
	Father, Mother & Siblings	18 (7.1%)
	None	118 (46.6%)
Father's Education	Uneducated	17 (6.7%)
	Primary	17 (6.7%)
	Middle	38 (15.0%)
	High School	78 (30.8%)
	Bachelor's	103 (40.7%)
Mother's Education	Uneducated	30 (11.9%)
	Primary	21 (8.3%)
	Middle	44 (17.4%)
	High School	69 (27.3%)
	Bachelor's	89 (35.2%)
Affected Organs by Allergy	More than two	129 (50.99%)
	Skin	55 (21.74%)
	GI Tract	47 (18.58%)
	Nose	9 (3.56%)
	Lungs	6 (2.40%)
	Eyes	3 (1.20%)
	Chest	4 (1.58%)
Types of Food Allergies	Dairy (milk, eggs)	78 (30.83%)
	Wheat	54 (21.34%)
	Nuts	38 (15.02%)
	Fish/Shellfish	35 (13.83%)
	Other	42 (16.60%)
	Multiple Allergies	6 (2.37%)
Nutritional Status	Stunted	90(35.6%)
	Wasted	25 (9.9%)
	Malnourishment (UW/OW)	33 (13.0%)
	Any two of the above	58 (22.9%)
	All of the above	31 (12.3%)
	None of the above	16 (6.3%)
Continuous Variables (Mean ± SD)		
Age (years)	Mean ± SD	8.82 ± 1.98
Weight (kg)	Mean ± SD	24.51 ± 8.37
Height (inches)	Mean ± SD	46.19 ± 5.00

Results of the Chi-square test showed an absence of a statistically significant relationship between FAIS scores, and the demographic or clinical variables chosen. Among participants with more than two affected organs, 62.5% reported a significant FAIS score; however, this association did not reach statistical significance ($p = 0.110$). Similarly, gender showed no meaningful relationship with FAIS scores, as 10.1% of

males and 9.0% of females had significant scores (p = 0.760). Nutritional status was also found to be independent of FAIS outcomes, with participants showing a significant FAIS score distributed across stunted (33.3%), wasted (8.3%), underweight/overweight (12.5%), any two forms of malnutrition (33.3%), all forms of malnutrition (8.3%), and no nutritional impairment (4.2%), and the association was not statistically significant ($\chi^2 = 1.888$, p = 0.864). Moreover, there was no profound connection between the FAIS scores and the level of education of their parents. While a slightly higher proportion of children with uneducated mothers (16.7%) and fathers (11.8%) had significant FAIS scores compared to their educated counterparts, these differences were not statistically significant (p = 0.153 and p = 0.740, respectively) (Table 2)

Table 2. Chi-square Test

Variable	Category	FAIS Significant n (%)	FAIS Non-significant n (%)	χ^2	p-value
Affected Organ	GI tract	1 (4.2%)	46 (20.1%)	10.375	0.110
	Skin	4 (16.7%)	51 (22.3%)		
	Nose	2 (8.3%)	7 (3.1%)		
	Lungs	2 (8.3%)	4 (1.7%)		
	Eyes	0 (0.0%)	3 (1.3%)		
	Chest	0 (0.0%)	4 (1.7%)		
	More than two	15 (62.5%)	114 (49.8%)		
Gender	Male	12 (10.1%)	107 (89.9%)	0.094	0.760
	Female	12 (9.0%)	122 (91.0%)		
Nutritional Status	Stunted	8 (33.3%)	82 (35.8%)	1.888	0.864
	Wasted	2 (8.3%)	23 (10.0%)		
	Malnourishment (UW/OW)	3 (12.5%)	30 (13.1%)		
	Any two of the above	8 (33.3%)	50 (21.8%)		
	All of the above	2 (8.3%)	29 (12.7%)		
	None of the above	1 (4.2%)	15 (6.6%)		
Father's Education	Uneducated	2 (11.8%)	15 (88.2%)	0.110	0.740
	Educated	22 (9.3%)	214 (90.7%)		
Mother's Education	Uneducated	5 (16.7%)	25 (83.3%)	2.044	0.153
	Educated	19 (8.5%)	204 (91.5%)		

This study found no significant association between daily life activities and nutritional status in children with food allergies, suggesting that other factors may contribute to their nutritional outcomes.

Discussion

This paper was based on the research commissioned to study the relationship between daily life performance and nutrition of the children with food allergies, with a population of 253 children with food allergies aged between 6-12. Validated instruments, namely CDC growth charts of nutritional status and the Food Allergy Impact Scale (FAIS) of day to day activities, were used to acquire the data in major tertiary hospitals in the city of Lahore. The Chi-square statistical interpretation has indicated that there were high prevalence of food allergies but it has not had significant effect on the nutritional statuses or daily activity of the children.

Interpretation of the results indicated that dairy (30.83%), wheat (21.34%), and nuts (15.02%) were the most common allergens, consistent with previous findings by Christie, who noted that the majority of childhood food allergies involve milk, eggs, wheat, soy, and nuts (1). The study showed that 35.57% of children were stunted, 13.04% were malnourished, and 9.88% were wasted, findings that mirrored national statistics reported in the National Nutrition Survey (2018) and Pakistan Demographic and Health Survey (2017–2018), both of which documented widespread undernutrition in Pakistani children (17, 18).

Regarding organ involvement, the majority of children (50.99%) experienced symptoms affecting two or more organ systems, followed by the skin (21.74%) and gastrointestinal tract (18.58%). Such findings correlated with the findings made by Sicherer who noted the most common sites of paediatric food allergies to include skin and the GI tract (6).

Although it is a prominent occurrence, this study was unable to obtain statistically significant relations between FAIS and nutritional status ($p = 0.864$), gender ($p = 0.760$), affected organ ($p = 0.110$), or parental education ($p = 0.740$ father and $p = 0.153$ mother). These findings contradict with some of the previous studies. To illustrate, Salsabila et al. showed a substantial correlation between FAIS and nutritional outcomes in the allergic children (OR = 0.161, $p = 0.007$) (9) and Stansgaard discovered differences in the perceived quality of life effect of food allergy based on the gender (19). In like manner, Mahmoud pointed out the fact that parent education played a major role in food-related decisions and outcomes among children with food allergies (20).

A certain basis of these unequal consequences could be the cultural and socioeconomic background of the present sample. Among Pakistani households and especially those in urban extended family setups, food preparation is mostly social and it is quite possible that it cushions the effect of food allergy on lifestyle choices. Areas of social activity like family trips or playing at the homes of friends may also not be very pertinent to it because many families in the restricted social environment do not have such activities often.

In the FAIS subdomains, although some responses indicated moderate perceived impacts such as on school attendance (34.8%), parental stress (34%), and sleep (32%) these did not meet the threshold for statistical significance. This may indicate that there is also a variation in the cultural concept of perception, coping, or insufficient reporting of chronic conditions due to the habitualization of such conditions within their family system.

The results of this examination indicate that despite the prevalence of food allergies in children in Pakistan and their implications on the functions of many of the organ systems of the human body, their quantifiable effects on daily life functions and nutritional implications can be mitigated by the structural organization of families, cultural behaviors, and societal standards. This low essential association does not fail to notice the relevance of food allergies but rather shows the possibility of a point lacking awareness, evaluation instruments, and cultural adaption of a global-based instrument such as FAIS. The findings may guide the efforts of the paediatric dietitian, school administrators, and public health professionals on the importance of putting more emphasis on targeted interventions and awareness campaigns, in line with the culture of Pakistani communities.

The present study was limited in a number of ways. On the one hand, the FAIS instrument has been further tested internationally, but it is doubtful whether this instrument embraces all the activities or issues of daily life of Pakistani families, thus, making the tool less sensitive. Second, the baseline nutrition status in Pakistan is already poor, as exhibited by the national surveys (17, 18), and there is very little chance of registering an incremental change of food allergy on the nutrition status. Third, due to the cross-sectional construction of the study, causal interpretations are

restrained. Also, the results were self-reported by mothers, and the presence of reporting or recalling bias occurs. Finally, the sample, although acquired in several hospitals, might not be comprehensive of rural and those beyond the tracts of tertiary healthcare systems.

Conclusion:

This study concluded that there is no statistically significant correlation between normal childhood activity and nutrition status of children with food allergy. Although an allergen in food can alter some growth indicators and various aspects of everyday life, the evidence in point points to the fact that, on the one hand, this effect is not proven to be consistent, among this age group. In turn, these findings provide evidence of the need to investigate further the variables and contextual conditions under which this relationship might be modulated.

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Conflict of interest

No

Funding source

No

Authors' Contribution:

- **Farwa Zulfiqar:** Conceptualization of the study, supervision, and critical revision of the manuscript.
- **Eman Mukhtar:** Study design, data collection, data analysis, and manuscript writing.
- **Ayesha Saeed:** Administrative support, study oversight, and final approval of the manuscript.
- **Maryam Waqar:** Data collection, data entry, and literature review.
- **Kiran Ashraf:** Data interpretation and clinical insights.
- **Muskan Javed:** Statistical analysis and proofreading of the manuscript.
- **Ayesha Amjad:** Data collection and manuscript formatting.
- **All authors:** Read and approved the final version of the manuscript.