ORIGINAL RESEARCH ARTICLE

Biochemical and Nutritional Profiles in Asthma Patients with and without Perceived Food Allergies: A Hospital-Based Case-Control Study in India

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Background: Asthma is a global health concern with multifactorial origins, remains a subject of extensive research, notably in its relationship with perceived food allergies (FAs).

Objective: This study investigated biochemical markers and nutrient profiles among adult asthma patients (Hyderabad, India) with and without perceived FA, aiming to illuminate dietary impacts on asthma management.

Methods: A case-controlled study was conducted with 286 patients (143 asthmatics with perceived FA and 143 age, sex, socioeconomic status matched asthmatics with no perceived FA) aged 15–40 years. Enrolled participants (n = 286) underwent spirometric evaluation, anthropometric measurements, and biochemical assays. The blood sample was collected, and food frequency questionnaire was recorded for laboratory investigations and nutrients calculation, respectively. Relevant biochemical parameters (complete blood, total serum Immunoglobulin E etc.) were analyzed in the blood samples and macro- and micro-nutrients (calories, protein, fat, vitamin-B complex, calcium etc.) were calculated and comparisons were made between the cases and controls.

Results: Most of the cases had higher body mass index (BMI) (27.5 ± 4.82) than controls (23.3 ± 4.51) ($p \leq 0.05$); 59(41.3%) and 46(32.2%) had BMI in the range of 25–30 and >30. The perceived FA in asthmatics was associated with biochemical parameters (hemoglobin, total leucocyte count, eosinophil and monocytes counts, serum IgE, serum protein and serum calcium) and nutrients [protein (42.24 ± 7.63 g/d), fat (23.86 ± 4.70 g/d), thiamine (0.77 ± 0.15 mg/d), riboflavin (1.20 ± 0.19 mg/d), pyridoxine (1.53 ± 0.16 mg/d), folic acid (70.80 ± 8.69 μg/d), cobalamine (0.70 ± 0.03 mg/d), ascorbic acid (34.51 ± 4.26 mg/d), calcium (304.10 ± 62.36 mg/d), and iron (17.94 ± 4.97 mg/d)] as compared to their counterparts with no perceived FA ($p \leq 0.05$).

Conclusion: These findings emphasize the intricate connection between diet, asthma, and atopy, advocating for personalized dietary interventions in asthma care. Future research should investigate micronutrient deficiencies, assess how BMI affects FAs, and conduct trials to understand dietary components' impact on asthma prevention and management. Asthmatics' self-avoidance of certain foods may lead to nutritional deficiencies and abnormal blood profiles, warranting confirmation of FA diagnoses and the formulation of suitable management approaches.

Keywords: asthma ▪ food allergy ▪ laboratory investigations ▪ nutrients intake ▪ body mass index

Asthma, a chronic respiratory condition, continues to be a global health concern with a rising prevalence in recent years.[1,2] While asthma has been the subject of extensive research and clinical attention, its multifactorial etiology remains a subject of ongoing investigation.[2] In this context, the intersection between asthma and perceived food allergies (FAs) has emerged as an intriguing area of study.[3,4] Perceived FAs, or adverse reactions to specific dietary components, have garnered increasing attention for their potential role in exacerbating asthma

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POPULAR SCIENTIFIC SUMMARY

- People with asthma who believe they have food allergies tend to have higher rates of being overweight and anemia.
- They also often have higher levels of a substance called IgE in their blood and lower levels of protein and calcium.
- These findings show how asthma, food allergies, and what we eat are all connected, especially considering the variety of diets across different regions of India.

symptoms or influencing disease progression.[5,6] In the last 10 years, research has discovered various biochemical and cellular markers that represent diverse pathways contributing to asthma's complexity.[7] The relationship between asthma and FAs is multifaceted, involving immunological, dietary, and genetic factors that interplay to influence an individual's clinical presentation and response to treatment.[5] Ensuring a balanced diet covering the proper levels of micro-, macro-nutrients, and vitamins can potentially enhance asthma management and alleviate its symptoms.[8]

India's rich culinary traditions, characterised by a multitude of ingredients and preparations, present a unique context to investigate how dietary factors may impact asthma outcomes. Furthermore, the nutritional status and dietary habits of asthma patients in India are influenced by socioeconomic factors, cultural practices, and regional variations, all of which can profoundly affect their overall health and well-being.[9]

This study aims to delve into a comprehensive analysis of biochemical markers and nutrient profiles and strives to contribute to the growing body of knowledge surrounding asthma management, potentially offering new avenues for personalized therapeutic strategies tailored to the unique dietary and nutritional needs of Indian asthma patients.

MATERIALS AND METHODS

Study participants

This study was carried out among clinically and spirometrically diagnosed asthma patients attending the outpatient clinic at Department of Pulmonary Medicine, Gandhi Medical College, Hyderabad, and controls aged between 15 and 40 years from 2010 to 2012. A total of 286 participants (143 cases – asthma patients with perceived FA and 143 controls – comparable age, sex, SES asthma patients without perceived FA) were enrolled in the study. The SES was assessed and compared based on the Kuppuswamy Scale.[10] Perceived FA was characterized by patients reporting that specific food item(s) triggered or exacerbated their asthma symptoms. The study was approved by the Ethics Committee of coordinating center (05/II/2016) and study site (IEC/GMC/2017). After explaining the Patient Information Sheet to the participants, who met all the inclusion and exclusion criteria and signed Informed Consent Document to participate in the study were included in the final analyses.

Pulmonary function test

Pulmonary function test (PFT) was performed in asthma patients as well as healthy controls. Curves for FEV1 and flow volume were obtained with a spirometer (P.K. Morgan's Spiro 232 Pulmonary System). FEV1 data were presented as percentages (100%) after adjusting for age and sex. Data confirming obstruction include increased residual volume and airway resistance, uneven distribution of ventilation, and decreased forced expiratory volume for 1 s (FEV1) according to the requirements of the American Thoracic Society.[11] Reversibility of airway obstruction in response to administration of an aerosol bronchodilator (400 mg of salbutamol) was measured according to the standard method of the American Thoracic Society.[11,12] A positive reversibility test was defined by an increase in FEV1 higher than 12% after inhalation of 400 mg of salbutamol.

Anthropometric measurements

Height: Participants' height was measured in centimeters using a stadiometer. They were instructed to stand upright against the stadiometer's vertical backboard. The stadiometer was then lowered gently until it touched the top of the participant's head, accounting for any hair, and the measurement was taken at that point.

Weight: Weight was measured using a digital scale in kilograms. Participants stood barefoot with even weight distribution on the scale. Prior to each measurement, the scale was calibrated to ensure accuracy by reading zero with no weight applied.

Body mass index (BMI): The BMI was calculated using the formula; weight (kg)/(height (m)).[2] Based on the calculated BMI, participants were categorized into different groups, such as underweight, normal weight, overweight, and obese, following established BMI thresholds.[13]

Biochemical measurements

Hemoglobin was estimated using cynmethemoglobin method and peripheral blood smears [total leucocyte count (TLC) and differential leucocyte count (DLC)] was determined using commercial kits (Vital Diagnostics Ltd., India).[14] Serum albumin (F055), serum calcium (MBS8243246), serum protein (SRGHE0080) and total serum IgE (Elagen Adaltis Italy) procedures were performed using ELISA according to manufacturer instructions.

Food frequency questionnaire

The food frequency questionnaire (FFQ) was developed and evaluated by drawing inspiration from an existing, previously published questionnaire focused on dietary habits.[15] A total of150 item semiquantitative FFQ was used to assess normal dietary intake during the previous 6 months. Nutrient intake was computed from the reported frequency of consumption of each specified unit of food or beverage and from published data on the nutrient content of the specified portions.[16] To help the participants to quantify food consumption, photographs showing servings with six progressive portions of the reported consumed foods were shown to the participants.

Participants were asked about their current smoking habits, including whether they were current smokers, former smokers, or non-smokers.

Statistical analysis

Statistical analyses were performed by using the SPSS statistical package version 22.0 (SPSS, Chicago, IL). The characteristics of cases and controls are expressed as mean/frequency and standard deviation/percentages and 95% confidence intervals for variables. Categorical data of cases and control groups was evaluated using the chi-square test and continuous normal values tested by *t*-test. Results were considered statistically significant if the observed two-sided significance level (*p*-value) was not greater than 0.05.

RESULTS

The demographic details revealed that most of the cases {108(75.5) [67.6–82.3]} and controls {103(72.0) [63.9–79.2]} belonged to the urban setting. It was also observed that most of the {121(84.6) [77.6–90.1] cases and 119(83.2) [76.1–88.9] controls)} reported that they never smoked. It was also observed that most cases {59(41.3) [33.1–49.8]} fell in the BMI range of 25–30 (pre-obesity) compared to the control population {43(30.1) [22.7–38.3]}. Only 32(22.4) [15.8–30.1] of asthmatics fell in the normal BMI range of 18.5–25 whereas, nearly 78(54.5) [46.0–62.9] of the control group had a normal BMI of 18.5–25 (Table 1).

Asthmatics with perceived FA were anemic with hemoglobin level measured to be 9.7 ± 1.2 (9.5–9.9) mg/dl, which was significantly low ($p < 0.001$) compared to control group [12.6 ± 1.2 (12.4–12.8)]. Similarly, TLC among the cases was 14468.2 ± 7987.7 (13159.0–15777.4) per cu.mm and was two times higher ($p < 0.001$) compared to control samples [7415.2 ± 1512.5 (7167.3–7663.1) per cu.mm]. Differential leukocyte counts revealed higher numbers of eosinophils [9.1 ± 5.4 (8.2–10.0)] and monocytes [5.3 ± 4.8 (4.5–6.1)] among the asthmatics with perceived FA compared to control group [4.1 ± 1.8 (3.8 – 4.4) and 1.8 ± 2.8 (1.3–2.3)] ($p < 0.001$). Total Serum IgE was high among the cases and was found to be 660.3 ± 423.1 (591.0–729.6) mg/dl, which was six-times higher ($p < 0.001$) compared to control group [104.4 ± 34.7 (98.7–110.1) mg/dl]. The asthma patients with perceived FA had lower concentration of serum proteins [61.5 ± 7.9 (60.2–62.8) g/lit] compared to controls [65.5 ± 7.4 (64.3–66.7) g/lit] ($p < 0.001$). However, serum albumin estimations showed no significant difference between the case and control groups ($p = 0.116$). Asthmatics with perceived FA had lower serum calcium [2.3 ± 0.1 (2.3–2.3) mmol/lit] compared to control group [2.8 ± 0.4 (2.7–2.9) mmol/lit] ($p < 0.001$) (Table 2).

Table 1. Demographic summary of the participants (*N* = 286).

Variables	Cases (*n* = 143) *n* (%) [95%CI]	Controls (*n* = 143) *n* (%) [95%CI]	*P*
Age (in yrs) mean ± SD	28.9 ± 5.8 [27.9–29.9]	28.7 ± 5.9 [27.7–29.7]	0.793
Residence			
Rural	35 (24.5) [17.7–32.4]	40 (28.0) [20.8–36.1]	0.591
Urban	108 (75.5) [67.6–82.3]	103 (72.0) [63.9–79.2]	
Smoking history			
Never smoker	121 (84.6) [77.6–90.1]	119 (83.2) [76.1–88.9]	0.804
Ex-smoker	19 (13.3) [8.2–20.0]	22 (15.4) [9.9–22.4]	
Current smoker	3 (2.1) [0.4–6.0]	2 (1.4) [0.2–5.0]	
Body mass index			
<18.5 (Underweight)	6 (4.2) [1.6–8.9]	16 (11.2) [6.5–17.5]	<0.001*
18.5–25 (Normal)	32 (22.4) [15.8–30.1]	78 (54.5) [46.0–62.9]	
25–30 (Overweight)	59 (41.3) [33.1–49.8]	43 (30.1) [22.7–38.3]	
>30 (obese)	46 (32.2) [24.6–40.5]	6 (4.2) [1.6–8.9]	
Mean ± SD	27.5 ± 4.8 [26.7–28.3]	23.3 ± 4.5 [22.6–24.0]	<0.001*

SD: standard deviation, CI: class interval, *$p \leq 0.05$.

Comparison of dietary intake between the cases (asthma patients with perceived FAs) and controls (asthma patients without perceived FAs) revealed significant differences in various nutrient consumption levels. The mean daily intake of protein was markedly lower in cases [42.2 ± 7.6 (41.0–43.4) compared to controls [51.4 ± 6.5 (50.3–52.5) g/d] (p < 0.001). Similarly, fat consumption was higher in cases [23.9 ± 4.7 (23.1–24.7) g/d] than controls [21.0 ± 4.5 (20.3–21.7) g/d] (p < 0.001). Regarding vitamin intake, the mean daily consumption of thiamine (Vit. B1) was significantly lower in cases [0.8 ± 0.2 (0.7 – 0.8) mg/d) compared to controls [1.0 ± 0.8 (0.9–1.1) mg/d] (p = 0.002). Riboflavin (Vit. B2) intake showed a similar trend, with cases [1.2 ± 0.2 (1.1–1.2) mg/d] having lower consumption than controls [1.3 ± 0.2 (1.3–1.3) mg/d) (p = 0.005). Pyridoxine (Vit. B6) intake was slightly higher in cases [1.5 ± 0.2 (1.4–1.5) mg/d] than controls [1.5 ± 0.2 (1.4–1.5) mg/d] (p = 0.005). Folic acid (Vit. B9) intake was also marginally lower in cases [70.8 ± 8.7 (69.4–72.2) µg/d] compared to controls [73.1 ± 9.1 (71.6–74.6) µg/d] (p = 0.030). Cobalamin (Vit. B12) intake was slightly reduced in cases [0.7 ± 0.03 (0.6– 0.7) mg/d] compared to controls [0.7 ± 0.02 (0.6–0.7) mg/d] (p = 0.021). Additionally, the mean daily intake of ascorbic acid (Vit. C) was significantly lower in cases [34.5 ± 4.3 (33.8–35.2) mg/d] compared to controls [36.6 ± 3.1 (36.1–37.1) mg/d] (p < 0.001). Calcium intake showed a significant difference, with cases [304.1 ± 62.4 (293.9–314.3) mg/d) consuming less than controls [322.5 ± 62.2 (312.3–332.7) mg/d] (p = 0.013). Iron intake was also significantly lower in cases [17.9 ± 5.0 (17.1–18.7) mg/d] compared to controls [19.8 ± 5.1 (19.0–20.6) mg/d] (p = 0.002) (Table 3).

DISCUSSION

Diverse dietary practices in India significantly impact asthma within varying cultural and regional contexts, influencing the nutritional status and overall health of patients. To the best of our knowledge, this study stands as the pioneering investigation, delving into the biochemical profile and nutrient status of adult asthma patients with perceived FAs in the Hyderabad population of South India. The demographic details showed that most of the population who participated in the study was from urban background, reflecting the urban-centric nature of the study cohort. In addition, a significant proportion of participants reported never having smoked, suggesting that smoking may not be a predominant factor in the asthma population under consideration. An epidemiological study[17] found that while smoking is less prevalent among individuals with asthma compared to the general population, one in four asthma patients continues smoking. These individuals experience notably more chronic cough and phlegm than both never smokers and ex-smokers. Thus, emphasizing the crucial need for smoking cessation in all asthma patients, including those with milder forms of the condition.

Asthma patients reporting FAs showed a higher incidence of pre-obesity/overweight (BMI 25–30) compared to those without FAs, while a larger proportion of asthma patients without perceived FAs fell within the normal BMI range (18.5–25). These findings emphasize the potential connection between BMI and asthma, highlighting a notable pre-obesity prevalence among asthmatics with perceived FA. Previous research[18] has often linked obesity to increased FAs, attributing immune system changes and gut barrier disruptions as possible causes. Furthermore, while numerous studies[19,20] have indicated a connection between obesity and asthma, particularly in adults. Chronic low-grade inflammation observed in overweight to obese individuals,[21] alongside linking obesity with higher IgE levels in women[22] and mechanisms involving adipose tissue's influence on the immune system, suggest a potential connection between obesity and allergies.[23] Variations in asthma prevalence

Table 2. Biochemical profile of the participants (*N* = 286).

Variables	Cases (*n* = 143) mean ± SD [95%CI]	Controls (*n* = 143) mean ± SD [95%CI]	*P*
Hemoglobin (g/dL)	9.7 ± 1.2 [9.5–9.9]	12.6 ± 1.2 [12.4–12.8]	<0.001*
TLC (per cu.mm)	14468.2 ± 7987.7 [13159.0–15777.4]	7415.2 ± 1512.5 [7167.3–7663.1]	<0.001*
DLC (%)			
Polymorphs	69.3 ± 9.9 [67.7–70.9]	66.3 ± 13.8 [64.0–68.6]	0.032
Lymphocytes	28.8 ± 9.9 [27.2–30.4]	27.2 ± 9.1 [25.7–28.7]	0.137
Eosinophils	9.1 ± 5.4 [8.2–10.0]	4.1 ± 1.8 [3.8–4.4]	<0.001*
Monocytes	5.3 ± 4.8 [4.5–6.1]	1.8 ± 2.8 [1.3–2.3]	<0.001*
Serum Ig E (mg/dL)	660.3 ± 423.1 [591.0–729.6]	104.4 ± 34.7 [98.7–110.1]	<0.001*
Serum protein (g/L)	61.5 ± 7.9 [60.2–62.8]	65.5 ± 7.4 [64.3–66.7]	<0.001*
Serum albumin (g/L)	41.5 ± 3.2 [41.0–42.0]	40.9 ± 3.3 [40.4–41.4]	0.116
Serum calcium (mmol/L)	2.3 ± 0.1 [2.3–2.3]	2.8 ± 0.4 [2.7–2.9]	<0.001*

SD: standard deviation, CI: class interval, *$p \le 0.05$, TLC: total leucocyte count, DLC: differential leucocyte count.

Table 3. Dietary profile of the participants (*N* = 286).

Variable	Cases (*n* = 143) mean ± SD [95%CI]	Controls (*n* = 143) mean ± SD [95%CI]	*p*
Energy (cal/d)	2074.7 ± 326.4 [2021.2–2128.2]	2042.3 ± 436.9 [1970.7–2113.9]	0.478
Protein (g/d)	42.2 ± 7.6 [41.0–43.4]	51.4 ± 6.5 [50.3–52.5]	<0.001*
Fat (g/d)	23.9 ± 4.7 [23.1–24.7]	21.0 ± 4.5 [20.3–21.7]	<0.001*
Thiamine (Vit. B1) (mg/d)	0.8 ± 0.2 [0.7–0.8]	1.0 ± 0.8 [0.9–1.1]	0.002*
Riboflavin (Vit. B2) (mg/d)	1.2 ± 0.2 [1.1–1.2]	1.3 ± 0.2 [1.3–1.3]	0.005*
Nicotinic acid (Vit. B3) (mg/d)	13.5 ± 1.8 [13.2–13.8]	13.6 ± 1.8 [13.3–13.9]	0.661
Pyridoxine (Vit. B6) (mg/d)	1.5 ± 0.2 [1.4–1.5]	1.5 ± 0.2 [1.4–1.5]	0.005*
Folic acid (Vit. B9) (µg/d)	70.8 ± 8.7 [69.4–72.2]	73.1 ± 9.1 [71.6–74.6]	0.030*
Cobalamine (Vit. B12) (mg/d)	0.7 ± 0.03 [0.6–0.7]	0.7 ± 0.02 [0.6–0.7]	0.021*
Ascorbic acid (Vit. C) (mg/d)	34.5 ± 4.3 [33.8–35.2]	36.6 ± 3.1 [36.1–37.1]	<0.001*
Calcium (mg/d)	304.1 ± 62.4 [293.9–314.3]	322.5 ± 62.2 [312.3–332.7]	0.013*
Iron (mg/d)	17.9 ± 5.0 [17.1–18.7]	19.8 ± 5.1 [19.0–20.6]	0.002*

SD: standard deviation, CI: class interval, Vit.: vitamin, *$p \leq 0.05$.

by gender, as seen in Korean adults, hint at malnutrition and obesity contributing to asthma mechanisms.[24] Furthermore, the role of metabolic dysfunction rather than fat mass alone in asthma related to obesity has been highlighted,[25] yet such investigations in the Indian context remain sparse, making this study pivotal in proposing a healthy BMI as a possible factor in mitigating allergy and asthma effects.

Asthma patients with perceived FA showed anemia with lower hemoglobin levels, elevated TLC, specifically higher eosinophil and monocyte counts, increased serum IgE levels indicating pronounced atopic responses, and lower serum protein and calcium levels, hinting at potential malabsorption or nutritional issues. Allergic adults, particularly males, face a 3.5-fold higher risk of developing iron deficiency anemia, while allergic females experience an increased risk of about 66%.[26] A study[27] examined the correlation between childhood anemia and atopic diseases, revealing a consistent association. Recent research[28,29] has connected iron deficiency with inflammatory disorders such as rheumatoid arthritis, chronic obstructive pulmonary disease, and irritable bowel disease. Iron levels affect the proliferation of Th subset cells, with deficiency favoring Th2 cell proliferation, altering the Th1/Th2 ratio, and potentially promoting allergic sensitization.[30] It further highlighted associations between maternal iron deficiency anemia and respiratory illnesses/allergies in children.[31] The study's results on adults found consistent links between asthma, FA and anemia in adults, highlighting the need for further exploration of the factors driving this association.

A decrease in TLC after consuming allergenic foods aligns with increased eosinophil levels, improving diagnostic accuracy.[32] Vaughan's 1934 leukopenic index observed significant changes in leukocyte counts post-ingestion to detect allergic reactions.[33] Asthma patients in a study of 53 individuals showed higher eosinophil (OR = 12.61, $p < 0.0001$) and basophil (OR = 6.00, $p < 0.0001$) counts and reduced monocytes (OR = 13.79, $p = 0.017$), indicating heightened chronic inflammation.[34] Eosinophils may contribute to asthma exacerbation through various mechanisms involving Th2 cytokines and virus infection-related proteins.[35]

IgE-mediated FAs rapidly trigger histamine release, causing immediate symptoms, distinct from delayed-onset non-IgE-mediated allergies.[36] Serum IgE levels, notably elevated in South Indian asthmatics[37] (151.95 IU/mL in healthy individuals to 1045.32 IU/mL in severe cases), hold diagnostic value for predicting atopy and type 2 asthma, essential for allergy management and diagnosis but normal ranges vary among ethnic groups.[38]

Changes in serum calcium levels are associated with acute respiratory failure, emphasizing the potential misrepresentation when solely assessing serum calcium.[39] The gold standard for accurate calcium status evaluation involves measuring ionized calcium levels.[40] A study[41] found the availability of highly sensitive C-reactive protein (hs-CRP) assays for detecting subtle changes in CRP levels within the reference range, facilitating the assessment of clinical inflammation. There was absence of estimation for serum proteins such as cytokines and other inflammatory markers and ionized calcium levels. Consequently, the lower serum protein and calcium levels observed among asthma patients, compared to the control group, were solely linked to reduced protein and calcium intake without considering other potential factors.

Despite similar calorie intake, asthma patients showed significant variations in micronutrient consumption, including vitamins and minerals. Asthma patients tended to consume lower protein and higher fat compared to the control group, which preferred a protein-rich, lower-fat diet.

Western world does not support an association between a Western diet and incident or prevalent adult asthma but does suggest a possible link between a Western diet pattern and adult asthma morbidity.[42] Observational studies[43,44,45] examine vitamins (A, C, D, E) and methyl donor nutrients (folate, B12, choline) concerning asthma. Thiamine hydrochloride can trigger allergic reactions, while riboflavin (vitamin B2) has demonstrated potential antihistamine effects. Since histamines are known to have a very important role to play in allergies and asthma supplementation with riboflavin might help in relieving the patients from intensity of asthma attacks. A study[46] found higher riboflavin intake alleviates lung issues related to dibutyl phthalate exposure; vitamin B6 supplementation reduced allergy and asthma symptoms.[47] Vitamin C showed promise in reducing post-exercise FEV1 decline by 48%[48] and asthma attacks by 89%,[49] hinting at its potential in slowing lung function decline[50] and aiding in chronic obstructive pulmonary disease prevention.[51] Folic acid is vital for preventing neural tube defects but its intake in pregnant women may increase the risk of allergic diseases in infants, particularly respiratory tract allergies.[52] Conflicting studies persist regarding its role in preventing allergies in babies, with some advocating higher doses while others showing no direct link between maternal intake and childhood allergies or asthma.[53]

Vitamin B12's impact on folate metabolism is significant,[54] but its relationship with childhood asthma, atopy, wheezing, or eczema lacks consistent findings across studies,[55,56] requiring more research for clarification.

Lower calcium levels in allergy patients due to limited dairy intake from negative beliefs about dairy contrast previous research[57] suggests calcium's limited role in alleviating allergies. Recent research[58] underscores vitamin D's correlation with allergy prevention, though the present study didn't assess vitamin D levels. Studies link prenatal vitamin D supplementation (in Ireland)[59] and adequate maternal vitamin D (in India)[60] to reduced offspring asthma/allergy risks. However, limited data exist on diverse biochemical profiles and diets in adult asthma patients with or without perceived FAs.

The study on asthma, perceived FAs, and their connection to biochemical markers and nutrient profiles not only holds key strengths but also notable limitations. Nonetheless, its limitations, including a narrow geographical focus, a small sample size, a cross-sectional design, and reliance on self-reported data, could restrict generalizability and causal inferences. Limited consideration of confounding variables and absence of comprehensive biochemical parameters and longitudinal follow-up pose significant constraints.

CONCLUSION

The study provides valuable insights into the potential links among asthma, perceived FAs, and the biochemical-nutritional profiles of individuals in Hyderabad, India. It underscores the importance of dietary considerations in managing asthma within the Indian context, suggesting avenues for tailored therapeutic approaches. These efforts would offer a more nuanced comprehension of managing asthma and FAs. Emphasizing the intricate relationship between dietary factors, asthma, and atopy, future research should conduct population-based studies on micronutrient deficiency and explore the role of BMI in FAs. Furthermore, imperative intervention trials are warranted to authenticate the influence of dietary components such as antioxidants, fiber, and vitamins in controlling and preventing asthma.

ARTICLE INFORMATION

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Conflicts of interest

There is no conflict of interest.

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