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Prevalence and Associated Factors of Sensitization to Food Allergens in Congolese Children with Atopic Dermatitis

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Abstract

Background: Research on the role of diet in the pathogenesis of atopic dermatitis remains a relatively underexplored field, particularly on the African continent and more specifically in the Democratic Republic of Congo. The objective of this study was to determine the prevalence and associated factors of sensitization to food allergens among Congolese children with atopic dermatitis. **Methods:** A cross-sectional descriptive and analytical study was conducted between June and September 2025. The study included 101 patients aged between six months and fourteen years, all diagnosed with atopic dermatitis and subjected to skin prick tests to detect food-related allergic reactions. Data collected were recorded and analyzed using the Statistical Package for Social Sciences version 27. **Results:** The study participation rate was 29.5%. Sensitization to at least one food allergen

was observed in 35.6% of the subjects. The most common sensitizations were to peanuts (20.8%) and African eggplant (16.8%). Data analysis showed that food sensitization was significantly associated with several clinical and demographic variables, including age under one year ($p = 0.002$), male sex ($p = 0.000$), residence in an urban area ($p = 0.004$), late introduction of solid foods (weaning at ≥ 6 months) ($p = 0.008$), severe atopic dermatitis ($p = 0.004$), and early onset of dermatitis (≤ 3 months) ($p = 0.001$). **Conclusion:** A high prevalence of sensitization to food allergens, particularly peanuts and African eggplant, was found among Congolese children with atopic dermatitis. A significant association was also observed between this sensitization and several sociodemographic and clinical variables.

Keywords: Associated factors, food allergens, children, atopic dermatitis, Democratic Republic of Congo

Introduction

Atopic dermatitis (AD) is a chronic dermatological condition characterized by significant inflammation and intense pruritus, with a notably high prevalence in the pediatric population (Li H and al., 2021). A pathognomonic element of AD lies in cutaneous xerosis, which is intrinsically linked to impaired integrity and functionality of the epidermal barrier, often exacerbated by genetic abnormalities such as mutations affecting the filaggrin-encoding gene (Mortz Charlotte G and al., 2021). Moreover, various environmental determinants such as exposure to ultraviolet radiation, air pollution, household hygiene practices, and climatic variations are recognized as major contributors to the multidimensional clinical expression of this dermatosis (Boguniewicz M and al., 2011). Experimental studies using animal models suggest that environmental allergens, including proteins derived from food sources, may interact with the immune system through antigen-presenting cells located in the superficial epidermal layer. This interaction can trigger immune sensitization capable of initiating or exacerbating clinical manifestations of atopic dermatitis (Christensen M O and al., 2023). Furthermore, epidemiological data indicate that approximately 30 to 40% of children with moderate-to-severe atopic dermatitis also present with a confirmed comorbidity of food allergy (Muraro A and al., 2014; Eigenmann PA and al., 1998 & Eller E and al., 2009). The prevalence of specific food allergens capable of triggering atopic dermatitis (AD) varies considerably depending on the geographical region (Eller E and al., 2009). In European epidemiological data, hen's egg and cow's milk proteins rank as the most predominant food allergens, ahead of other well-recognized allergens such as peanuts, tree nuts, sesame, fish,

soy, and gluten (wheat) (Eller E and al., 2009). Research concerning the role of diet in the pathogenesis of atopic dermatitis remains a relatively underexplored field, particularly on the African continent and more specifically in the Democratic Republic of Congo. Therefore, the objective of this study was to determine the prevalence and associated factors of sensitization to food allergens among Congolese children with atopic dermatitis

Methods

Study design and type:

Between June and September 2025, we conducted a descriptive and analytical cross-sectional study aimed at determining the prevalence and associated factors of sensitization to food allergens within a Congolese pediatric cohort suffering from atopic dermatitis. Patient recruitment was carried out in the Dermatology Department of the Provincial Hospital of North Kivu (HPNK), using a non-probabilistic sampling approach.

Data collection methods and instrumentation:

To gather information regarding sociodemographic and clinical characteristics, a questionnaire was distributed to the parents or legal guardians of the patients. In addition, a thorough physical examination was performed on each participant to document the clinical signs of atopic dermatitis (AD). Seasonal timing of symptom occurrence was also systematically recorded. The diagnosis of AD was confirmed by a qualified dermatologist (Ngolo M.P.), strictly based on the diagnostic criteria established by Hanifin and Rajka. The severity of AD was assessed using the SCORAD index. Interpretation of SCORAD scores was as follows: a score below 25 indicated mild AD, a score between 25 and 50 indicated moderate AD, and a score above 50 indicated severe AD.

Skin prick tests were performed to identify specific food allergens responsible for AD flare-ups. Approval from the participating children was sought, and written informed consent was obtained from their parents or legal guardians before carrying out the skin tests. The prick tests were performed using native food allergens brought by the parents and/or guardians, suspected of causing exacerbation of lesions. ALK Lancet diagnostic lancets were used, with histamine as the positive control and physiological saline solution as the negative control, to ensure result validity. The reading was performed at 10 minutes for histamine and 20 minutes for tested foods. The anterior forearm was the preferred site for most children, while the back was used for some infants.

Rigorous measurement of the maximum and minimum diameter of each reaction was carried out using a millimeter-graduated ruler; the mean of

these two measurements was then calculated. A wheal diameter ≥ 3 mm was interpreted as a positive result, indicating clinically relevant allergic sensitization. When a prick test was positive (wheal diameter ≥ 3 mm), food sensitization was recorded.

Inclusion criteria:

Eligible participants were patients aged six months to fourteen years diagnosed with atopic dermatitis (AD), who had undergone a standardized skin prick test to determine their sensitization profile to food allergens (trophallergens).

Exclusion criteria:

Patients with AD receiving systemic or topical corticosteroids, antihistamines, or immunosuppressive therapies at the time of investigation were excluded. Additionally, those with active skin lesions at the testing site, or whose parents/legal guardians did not provide informed consent, were not included in the study.

Data analysis methods:

Collected data were recorded and processed using Statistical Package for Social Sciences (SPSS) version 27. Microsoft Excel and Word 2007 were used to organize data into tables. Qualitative variables were summarized as absolute and relative frequencies, while age was summarized using mean and range values. Pearson's Chi-square test was used for comparison of proportions; statistical differences were considered significant when $p < 0.05$.

Results

1. Basic Information

Out of a total of 342 cases of atopic dermatitis (AD) recorded, 101 were included in the final analysis, corresponding to a participation rate of 29.5%. Among them, 30 patients (29.7%) presented severe AD. Food allergy sensitization confirmed by skin prick testing was observed in 36 patients, representing 35.6% of the cohort.

The mean age was 4 ± 7 years, with extremes ranging from 6 months to 14 years. A slight male predominance was recorded, with 52.4% boys and a sex ratio (M/F) of 1.1. Moreover, urban residency was largely predominant, with 79.2% of the patients living in an urban area.

AD symptoms were mostly reported during the dry season (56.4%). A delayed introduction of solid foods was noted in 56.4% of the children, while 31.7% developed AD before the age of three months.

Regarding sensitization to food allergens, the skin prick test revealed that the most common allergens were peanut (20.8%) and African eggplant (16.8%). ***(Table I)***

Table I: Food allergens tested by skin prick test

Food allergens	Positive prick test ≥ 3 mm n (%)	Negative prick test < 3 mm n (%)
Peanut	21(20.8)	80(79.2)
African eggplant	17(16.8)	84(83.2)
Cow's milk	14(13.9)	87(86.1)
Egg	13(12.9)	88(87.1)
Meat (red and white)	13(12.9)	88(87.1)
Wheat	10(9.9)	91(90.1)
Smoked and salted fish	9(8.9)	92(91.1)
Potato	7(6.9)	94(93.1)
Fresh fish	6(5.9	95(94.1)
Cassava leaves	4(4.0)	97(96.0)
Sweet potato leaves	3(3.0)	98(97.0)
Beans	3(3.0)	98(97.0)
Okra	2(2.0)	90(98.0)
Palm oil	2(2.0)	90(98.0)

2. Correlations between food sensitization and sociodemographic and clinical variables

Data analysis revealed that food sensitization was significantly correlated with several clinical and demographic variables, including age under one year ($p = 0.002$), male sex ($p < 0.001$), residence in an urban area ($p = 0.004$), delayed introduction of solid foods (diversification at ≥ 6 months) ($p = 0.008$), the presence of severe atopic dermatitis ($p = 0.004$), and early onset of atopic dermatitis (≤ 3 months) ($p = 0.001$) ***(Table II).***

Table II: Univariate analysis between sociodemographic variables and food allergen sensitization

Frequently consumed foods (≥ 3 times per week)	Prick -test		p-value
	Positive or ≥ 3 mm wheal n= 36(%)	Negative or < 3 mm wheal n= 65(%)	
Age group			0.002
6 monts to 5years	106(86.9)	122(55.5)	
6 – 10 years	16(13.1)	98(44.5)	
11 – 14 years			
Sex			0.000
Male	21(58.3)	28(43.1)	
Female	15 (41.7)	37(56.9)	
Area of Residence			0.004
Urbain	35(97.2)	45(69.2)	
Rural	0(0.0)	9(13.8)	
Others	1(2.8)	11(16.9)	
Parent's occupation			0.142
Workers	30(83.3)	23(35.4)	
Unemployed	6(16.7)	42(64.6)	
Season of consultation			0.261

Dry Season	23(63.9)	34(52.3)	
Rainy Season	13(36.1)	31(47.7)	
Personal or family history of atopy			0.204
Yes	13(36.1)	32(49.2)	
No	23(63.9)	33(50.8)	
Severity of ad			0.004
Yes	20(55,6)	10(15,4)	
No	16(44.4)	55(84.6)	
Food diversification			0.008
Early (≥ 6 mois)	6(16.7)	38(58.5)	
Late(>6mois)	30(83.3)	27(41.5)	
Onset of ad			0.001
< 3 months	6(16.7)	23(35.4)	
3 to 6 months	1(2.8)	20(30.8)	
6 to 9 months	2(5.6)	17(26.2)	
> 9 months	27(75.0)	5(7.7)	
Other areas of residence: Bukavu, Béni, Uvira, …. AD: atopic dermatitis			

Discussion

The study aimed at determining food allergen sensitization in Congolese children with atopic dermatitis (AD) goes beyond a purely therapeutic perspective. Current scientific literature shows a notable scarcity of studies on food allergen sensitization in sub-Saharan Africa. Among the few available studies from this region, the prevalence of sensitization observed in the present study was lower than that reported in Mali (Teclessou J and al., 2018). Regarding the profile of food sensitization, our findings are consistent with data from other sub-Saharan African countries, where peanut represents the major allergen (Teclessou J and al., 2018 & Agodokpessi G and al., 2018). These observations differ from European studies, which show a predominance of cow's milk. While methodological heterogeneity may partly explain this discrepancy, it is also likely that local dietary habits and culinary practices play an important role in the occurrence of sensitization. Concerning eggplant and atopic dermatitis, there is limited scientific evidence suggesting a direct correlation. Nevertheless, some studies have identified associations between eggplant consumption and dermatological manifestations, specifically allergic contact dermatitis and lichenoid-type reactions. These observations are supported by studies conducted by Kabashima et al. in Japan and Palla S et al. in India (Kabashima K and al., 2004 & Palla S and al., 2024).

The risk of food allergen sensitization was higher in infants under one year of age. This sensitization in this patient group can be explained by two fundamental deficits: impaired skin barrier integrity and immaturity of the immune defense system (Scott H Sicherer and al., 2020). These findings align with previous studies, notably those by Scott H. Sicherer et al. in New

York and Stephan Gabet in France (Scott H Sicherer and al., 2020 & Stephan Gabet, 2017). Male sex was identified as a significant risk factor for food allergen sensitization. Our observations are consistent with previous studies reporting a higher prevalence of food allergies in males under 15 years with atopic dermatitis (Chen W and al., 2008 & Elbany C and al., 2025). Interestingly, this trend reverses in young females and stabilizes after menopause. This sex difference is largely attributed to hormonal variations, particularly testosterone, estrogen, and progesterone (Elbany C and al., 2025). Testosterone has anti-inflammatory effects and modulates inflammatory processes, whereas estrogen and progesterone, by stimulating immune cells, tend to exacerbate inflammation. Due to relatively low testosterone levels in prepubertal boys, they are more susceptible to allergies and allergic reactions (Chen W and al., 2008 & Elbany C and al., 2025).

Comparative epidemiological data show a notable and statistically significant increase in the prevalence of food allergen sensitization among individuals living in urban areas compared to rural areas. Current scientific knowledge offers limited information on the precise effects of urbanization on food allergen sensitization in children with atopic dermatitis. However, within the context of our study, a causal link is plausible between this sensitization and several factors associated with the urban environment (Xin Zhang and al., 2023). First, air pollution generated by industrial activity and vehicular emissions may compromise the intrinsic quality of food, potentially affecting nutritional content, safety, and microbial integrity. During production, processing, or preparation, food may be exposed to various contaminants, including bioaerosols such as microorganisms (fungi, bacteria, viruses) and allergens (dust mites, molds) (Xin Zhang and al., 2023 & Rachel L Peters and al., 2022)

Second, dietary habits in urban areas are gradually converging toward Western-style diets, involving increased consumption of industrially processed foods, which are associated with high concentrations of sodium, nitrites, processed ingredients, and microbial fermentation products (Matthias J and al., 2019). Studies by Yajia Li et al. identified sodium as a potential mechanism linking processed foods to AD (Yajia Li and al., 2021). Experimental results align with previous in vitro analyses, which showed that sodium chloride (NaCl)-induced modulation of ion signaling drives T lymphocyte polarization toward a TH2 phenotype, a recognized marker of AD pathophysiology (Gittler JK and al., 2012). NaCl has also been shown to amplify the inflammatory cascade by increasing the release of TH2-specific cytokines, notably IL-4 and IL-13 (Paul WE and al., 2010).

Consistent with existing literature, late introduction of solid foods was identified as a risk factor for food allergen sensitization. These findings support the notion that early introduction of solid foods could serve as an

effective preventive strategy against atopic dermatitis. Research by Brough and Prescott highlights the potential benefits of early allergen exposure in promoting mucosal immune maturation (Brough HA and al., 2020 & Prescott SL and al., 2008). This process establishes a complex network of immune tolerance, which may attenuate the inflammatory cascade that leads to allergen sensitization and the development of atopic dermatitis in early childhood (Brough HA and al., 2020 & Prescott SL and al., 2008). Data analysis also revealed a statistically significant correlation between early-onset atopic dermatitis (before three months of age) and subsequent food allergen sensitization. This observation is corroborated by previous studies conducted by Martin PE et al., (Martin PE and al., 2015).

Finally, our study has limitations, notably the low statistical power due to the small sample size and the self-selected nature of the survey, which limits the generalizability of the findings.

Conclusion

A high prevalence of food allergen sensitization, particularly to peanuts and African eggplant, was observed in Congolese children with atopic dermatitis. Furthermore, a significant correlation was identified between this sensitization and several sociodemographic and clinical variables, including male sex, urban residence, late introduction of solid foods (diversification at ≥ 6 months), the presence of severe atopic dermatitis, and early onset of the disease. A large-scale study would allow for a deeper understanding of sensitization to common food allergens in Congolese children with atopic dermatitis.

Conflict of Interest: The authors reported no conflict of interest.

Data Availability: All data are included in the content of the paper.

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References:

1. Li H, Zhang Z, Zhang H, Guo Y, Yao Z. (2021). Update on the patho genesis and therapy of atopic dermatitis. Clin Rev Allergy Immunol, 61(3), 324–338.
2. Mortz Charlotte G, du Toit George, Beyer Kirsten, Bindslev-Jensen Carsten, Brockow Knut, Brough Helen Annaruth, and al. (2021). When and how to evaluate for immediate type food allergy in children with atopic dermatitis. Allergy,76(12), 3845–3848.

3. Boguniewicz M, Leung D. (2011). Atopic dermatitis: A disease of altered skin barrier and immune dysregulation. Immunological Reviews, 242(1), 233–246.
4. Christensen M O, Barakji Y A, Loft N, Khatib CM, Un Egeberg, Thomsen S F, and al. (2023)Prevalence and association between atopic dermatitis and food sensitivity, food allergy and challenge-proven food allergy: A systematic review and meta-analysis. JEADV, 37(5), 984-1003.
5. Muraro A, Werfel T, Hoffmann-Sommergruber K, Roberts G, Beyer K, Bindslev-Jensen C, and al. (2014). EAACI food allergy and anaphylaxis guidelines: diagnosis and management of food allergy. Allergy, 69(8),1008–1025.
6. Eigenmann PA, Sicherer SH, Borkowski TA, Cohen BA, Sampson HA. (1998). Prevalence of IgE-mediated food allergy among children with atopic dermatitis. Pediatrics, 101(3), E8.
7. Eller E, Kjaer HF, Host A, Andersen KE, Bindslev-Jensen C. (2009). Food allergy and food sensitization in early childhood: results from the DARC cohort. Allergy, 64(7), 1023–1029.
8. Teclessou J, Kombate K, Douti N, Kabissa A, Akakpo A, Saka B, et al. (2018) Profil de sensibilisation aux pneumallergenes et aux trophallergenes chez les patients ayant une dermatite atopique à Lomé : etude de 83 cas. *Journal De La Recherche Scientifique De l'Université De Lomé*, *19*(3), 383–388.
9. Agodokpessi G, Dossou-Yovo S, Hountohotegbe T, Panouc M, Djogbessic D, Bigot C et al. (2018). Évaluation de la sensibilisation à 3 trophallergènes courants chez les enfants suivis pour asthme et ou rhinite allergique en Afrique subsaharienne : étude comparée du prick-test et du dosage des IgEs à Cotonou, Bénin. Revue Française d'Allergologie, 58(5), 361-366.
10. Kabashima K, Miyachi Y. (2004). Contact dermatitis due to eggplant. Contact Dermatitis, 50, 101–102.
11. Palla S, Srinivasan AR, Subramanian K, Shekar V. (2020). Oral allergy syndrome associated with eggplant particles presenting as a lichenoid reaction - sequential diagnostic workup and long-term follow-up. Indian J Dermatol. 2020, 65, 550–552.
12. Scott H Sicherer, Christopher M Warren, Christopher Dant, Ruchi S Gupta, and Kari C Nadeau. (2020). Food allergy from early childhood to adulthood. J Clin Allergy Immunol Pract, 8(6), 1854-1864.
13. Stephan Gabet. (2017). Sensibilisation allergénique au cours des huit premières années de vie, facteurs et morbidité associés dans la

cohorte de naissances PARIS. Thèse de médecine. Université Sorbonne Paris. Extrait de https://theses.hal.science/tel-01908958v1.
14. Chen W, Mempel M, Schober W, Behrendt H, Anneau J. (2008). Gender difference, sex hormones, and immediate type hypersensitivity reactions. Allergy, 63(11), 1418-27.
15. Elbany C, Bégin P. (2025). Influence du sexe sur l'épidémiologie, la sévérité et la réponse au traitement de l'allergie alimentaire. Revue Française d'Allergologie, 65 (1), 104159.
16. Xin Zhang , Chan Lu , Yuguo Li , Dan Norbäck , Padmini Murthy , Radim J Sram , Qihong Deng . (2023). Early exposure of children to air pollution associated with food allergy: implications of the concept of a single allergy. Environ Res, 216(3),114713
17. Rachel L Peters , Suzanne Mavoa , Jennifer J Koplin. (2022). An overview of environmental risk factors for food allergy. Int J Environ Res Public Health, 19(2), 722.
18. Matthias J, Maul J, Noster R, Meinl H, Chao YY, Gerstenberg H, and al. (2019). Sodium chloride is an ionic checkpoint for human TH2 cells and shapes the microenvironment of atopic skin. Sci Transl Med, 11(480), eaau0683.
19. Yajia Li, Juan Su, Dan Luo, Yanying Duan, Zhijun Huang, Meian He, and al. (2021). Processed foods and atopic dermatitis: a pooled analysis of three cross-sectional studies in Chinese adults. Front. Nutr, 8, 754663.
20. Gittler JK, Shemer A, Suarez-Farinas M, Fuentes-Duculan J, Gulewicz KJ, Wang CQ, and al. (2012). Progressive activation of T(H)2/T(H)22 cytokines and selective epidermal proteins characterizes acute and chronic atopic dermatitis. Journal of Allergy and Clinical Immunology,130, 54–1344.
21. Paul WE, Zhu J. (2010). How are T(H)2-type immune responses initiated and amplified? Nat Rev Immunol,10, 35-225.
22. Brough HA, Nadeau CR, Sindher SB, Alkotob SS, Chan S., Bahnson HT, and al. (2020). Epicutaneous sensitization in the development of food allergy: what is the evidence and how can it be prevented? Allergy, 75, 2185- 2205.
23. Prescott SL, Smith P, Tang M, Palmer DJ, Sinn J, Huntley SJ, and al. (2008). The importance of early complementary feeding in the development of oral tolerance: concerns and controversies. Pediatr. Allergy Immunol, 19, 375- 380.
24. Martin PE, Eckert JK, Koplin JJ, Lowe AJ, Gurrin LC, Dharmage SC, and al. (2015). Which infants with eczema are at risk of food allergy?. Results from a population-based cohort. Allergy Clin Exp, 45(1), 64-255.