Allergologia et immunopathologia
Sociedad Española de Inmunología Clínica, Alergología y Asma Pediátrica
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ORIGINAL ARTICLE

OPEN ACCESS

Investigating the seasonal effects of bee sting allergies on anxiety, somatization, and quality of life in children

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Received 18 July 2025; Accepted 11 November 2025
Available online 1 March 2026

KEYWORDS
anxiety;
bee sting allergies;
pediatric allergy;
somatization;
quality of life

Abstract
Objective: Bee stings, a prevalent issue globally, trigger severe allergic reactions and significantly impact physical health. However, their effects on psychologic well-being and quality of life, especially across seasons, are less understood. This study evaluates the impact of bee sting allergies on anxiety, somatization, and quality of life in children, with a focus on seasonal differences.
Methods: Conducted at the Medical Faculty of Erciyes University, this prospective study involved 106 children aged 6–18 years—53 with bee sting allergies and 53 healthy controls. Assessments using the Screen for Child Anxiety-Related Disorders (SCARED), Children's Somatization Inventory-24 (CSI-24), and Pediatric Quality of Life Inventory (PedsQL) were performed in winter and spring.
Results: Children with bee sting allergies exhibited significantly higher anxiety and somatization compared to controls, with lower quality of life scores in physical, emotional, and academic domains. Seasonal variations showed increased anxiety in spring, with fluctuating somatization and quality of life indicators, although these changes were not statistically significant.
Conclusion: Bee sting allergies significantly affect children's anxiety, somatization, and quality of life, with seasonal changes exacerbating these impacts. Targeted interventions are needed to address these challenges, particularly during peak allergen periods.

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https://doi.org/10.15586/aei.v54i2.1482

Introduction

Insect stings are a globally prevalent issue, with studies indicating that around 95% of individuals encounter at least one sting during their lifetime.[1] Reactions to insect stings can be categorized into local, large local, and systemic types. The insects commonly associated with allergic reactions are bees and wasps, both belonging to the *Hymenoptera* order.[2] Allergies to these insect stings are notable immunoglobulin E (IgE)-mediated reactions that can occur at any age. Given their potential to lead to severe and life-threatening reactions, such as anaphylaxis, these allergic responses are of significant clinical importance.[1,2]

Anxiety, characterized by excessive and irrational fear or worry, is one of the most widespread mental health conditions. It is marked by symptoms such as tension, unease, and apprehension, which can lead to significant behavioral and physical consequences. Individuals with anxiety disorders often struggle with cognitive challenges in managing stress and may have persistent fears about their ability to cope with anxiety-inducing situations, creating a self-reinforcing cycle of distress.[3]

Somatization, as defined by Lipowski, involves experiencing and expressing physical symptoms that lack an organic basis, attributing these symptoms to physical illness and seeking medical attention.[4] This phenomenon reflects the manifestation of psychologic distress through physical symptoms, highlighting the impact of psychosocial stress on physical health.[5]

Quality of life is a multifaceted and complex concept, encompassing an individual's subjective perception of their well-being in relation to their cultural values, personal goals, and expectations. According to the World Health Organization (WHO), quality of life is defined as an individual's perception of their position in life, considering their cultural and value systems, and personal goals and concerns.[6]

Anaphylaxis, a severe allergic reaction, can have profound impacts on individuals, potentially resulting in increased anxiety, somatization, and alterations in quality of life.[7] Despite understanding these impacts, there is a lack of research focusing on how these effects might vary with seasonal changes in insect sting prevalence, particularly between high-insect activity periods (spring) and low-activity periods (winter). This gap highlights the need for further investigation into how seasonal variations in insect sting frequency influence the psychologic and physiologic responses in affected individuals. This prospective study aims to determine the impact of insect sting allergies on anxiety, somatization, and quality of life in children who have these allergies.

Material and Methods

This prospective study was conducted at the Department of Pediatric Allergy, Erciyes University Medical Faculty, over a 1-year period from September 2023 to September 2024. The study population comprised children aged 6–18 years who were diagnosed with honeybee (*Apis mellifera*) or wasp (*Vespula* species) sting allergies. A total of 106 children were included: 53 patients with confirmed diagnoses of bee or wasp sting allergy and 53 healthy children as the control group.

Children aged 6–18 years who had been diagnosed with allergic reactions caused by honeybee or wasp stings within the past 5 years were included in the study based on clinical history, skin prick testing, and/or serum specific IgE measurements for honeybee and wasp venoms, provided that written informed consent was obtained from their parents or guardians. Children with allergic reactions to other insects as well as those with chronic diseases, other severe allergic conditions, psychiatric disorders, or cognitive impairments that could interfere with questionnaire completion were excluded from the study.

Data collection

Data were collected using structured questionnaires and medical records. For each participant, demographic information (name, age, and gender) and clinical data (presence of atopic diseases, skin prick test results, type of reaction to insect sting, and history of anaphylaxis) were recorded.

Three standardized scales were administered to all participants. The Screen for Child Anxiety Related Disorders (SCARED), developed by Birmaher et al.[8] to screen for childhood anxiety disorders, was used in this study. The Turkish version of the inventory, with established validity and reliability was created by Çakmakçı.[9] The inventory consists of 41 items, with a score of 25 or higher indicating a potential anxiety disorder.

The second scale, Children's Somatization Inventory-24 (CSI-24) (Child Form), was used to assess somatization in children. Developed by Walker et al.[10] in 1991 and revised in 2009, this inventory was adapted into Turkish by Kadıoğlu et al.[11] in 2012. The CSI-24 consists of 24 items rated on a 5-point Likert scale (0 = never, 1 = sometimes, 2 = often, 3 = very often, and 4 = always). It is a self-report measure evaluating the degree of distress caused by each symptom over the past 2 weeks. The total score is obtained by summing the scores for all items, ranging from 0 to 96, with higher scores indicating more intense somatic complaints.

Finally, the Pediatric Quality of Life Inventory (PedsQL) was utilized to evaluate the overall quality of life. This inventory includes items that assess physical, emotional, social, and school functioning.[12]

These assessments were conducted twice: first during the high insect activity period (spring) and second time during the low activity period (winter), and were administered to both study group (SG) and control group (CG).

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) software. Descriptive statistics were presented as mean ± standard deviation (SD) for continuous variables and as frequencies and percentages for categoric variables. Chi-Squared test and Fisher's Exact test were used to compare categoric variables between groups. The Shapiro–Wilk test was applied to assess the normality of data distribution. For non-normally distributed variables, the Wilcoxon Signed-Rank Test was used for comparisons between dependent groups, and the Mann–Whitney U Test was used for comparisons between independent groups. The relationship between variables

Table 1 Comparison of demographic characteristics of the study and control groups.

Parameters	Study group (n = 53)	Control group (n = 53)	P
Age (years)	15 (7–18)	13 (8–17)	0.327
Gender, n (%)			0.118
Male	35 (34)	28 (47)	
Female	18 (66)	25 (53)	
Eosinophilia n (%)			**<0.001**
Yes	17 (32)	1 (2)	
No	36 (68)	52 (98)	

Notes: Values are presented as median (minimum–maximum) for numeric variables and n (%) for categorical variables.
The Mann–Whitney U test was used for age comparison; Chi-squared test was used for gender distribution.

was evaluated using Spearman's Correlation Analysis; $P < 0.05$ was considered statistically significant.

The study protocol was approved by the Ethics Committee of Erciyes University. Researchers adhered to the Declaration of Helsinki during the study.

Results

A total of 106 patients participated in the study, comprising 54 males (51.9%) and 52 females (49.1%). The patients were divided into two groups: SG and CG. The SG included 53 patients (35 males [66%] and 18 females [34%]) with a median age of 15 years (range: 7–18 years). The CG also consisted of 53 patients (28 males [52.8%] and 25 females [47.2%]) with a median age of 13 years (range: 8–17 years). There were no statistically significant differences between the groups in terms of age ($P = 0.118$) or gender distribution ($P = 0.327$). Overall, the median age of the entire study population was 14 years (7–18 years). Table 1 shows the demographic and clinical characteristics of both groups. The detailed clinical characteristics of the children with bee sting allergy are presented in Table 2.

The median SCARED score for the entire study population was 17 (1–47). Winter SCARED, CSI-24, and PedsQL scores were evaluated separately for SG and CG.The median SCARED score was 22 (1–47) for SG and 14 (4–41) for CG ($P < 0.001$).The median CSI-24 score was 12 (0–38) for SG and 6 (0–23) for CG ($P < 0.001$).The median PedsQL total score was 73 (46–91) for SG and 88 (64–98) for CG ($P < 0.001$). The median values of physical, emotional, social, and academic functioning scores of PedsQL during winter for the study population were evaluated separately. The physical score was 78 (22–100) for SG and 90 (50–100) for CG. The emotional score was 75 (30–100) for SG and 90 (45–100) for CG. The social score was 100 (45–100) for SG and 100 (70–100) for CG. The academic functioning score was 75 (35–100) for SG and 85 (40–100) for CG ($P < 0.001$, $P < 0.001$, $P = 0.134$, and $P = 0.004$, respectively). Table 3 shows the comparison of the winter SCARED scores, CSI-24 scores, and PedsQL scores for both SG and CG.

The winter and spring SCARED scores, CSI-24 scores, and PedsQL scores of SG were compared. The winter SCARED scores for SG had a median value of 22 (1–47), while the spring SCARED scores had a median value of 29 (0–52) ($P = 0.003$). The winter CSI-24 scores for SG had

Table 2 Clinical characteristics of children with bee sting allergy (study group, n = 53).

Parameters	n (%)
Atopic comorbidity	
Asthma	4 (7.5)
Seasonal allergic rhinitis	8 (15.1)
Multiple allergies	3 (5.7)
No allergy	38 (71.7)
Reactions	
Anaphylaxis	40 (75.5)
Urticaria	2 (3.8)
Urticaria and angioedema	11 (20.8)
Eosinophilia	
Yes	17 (32)
No	18 (68)
Skin prick test	
Positive	11 (21)
Negative	42 (79)
Family history	
Yes	9 (17)
No	44 (83)
Spring adrenaline knowledge	
Yes	25 (47)
No	28 (53)
Winter adrenaline knowledge	
Yes	45 (85)
No	8 (15)

Notes: Values are presented as number of patients and percentage. Percentages may not total 100% because of rounding.
Multiple allergies were defined as the presence of two or more allergic diseases (e.g., asthma, allergic rhinitis, atopic dermatitis, or food allergy).
Reaction refers to bee stings.
The "spring/winter adrenaline knowledge" variable indicates whether parents were aware of the correct use of adrenaline autoinjector during winter and spring evaluations. The surveys were administered twice: first in winter (low insect activity period) and again in spring (high insect activity period).

Table 3 Comparison of winter SCARED, CSI-24, and PedsQL scores of the study and control groups.

Parameters	Study group (n = 53)	Control group (n = 53)	P
SCARED score	22 (1-47)	14 (4-41)	**<0.001**
CSI-24 score	12 (0-38)	6 (0-23)	**<0.001**
PedsQL scores			
Physical score	78 (22-100)	90 (50-100)	**<0.001**
Emotional score	75 (30-100)	90 (45-100)	**<0.001**
Social score	100 (45-100)	100 (70-100)	0.134
Academic scores	75 (35-100)	85 (40-100)	**0.004**

Notes: Values are presented as median (minimum-maximum). The Mann-Whitney U test was used to compare groups.
PedsQL: Pediatric Quality of Life Inventory; CSI-24: Children's Somatization Inventory-24; SCARED: Screen for Child Anxiety-Related Disorders.

a median value of 12 (0-38), while the spring CSI-24 scores had a median value of 10 (0-31) (P = 0.093). The median values of physical, emotional, social, and academic functioning scores of PedsQL during winter and spring for the study population were compared separately. The physical score was 78 (22-100) in winter and 78 (28-100) in spring. The emotional score was 75 (30-100) in winter and 65 (25-100) in spring. The social score was 100 (45-100) in winter and 95 (40-100) in spring. The academic functioning score was 75 (35-100) in winter and 65 (35-100) in spring (P = 0.177, 0.86, 0.054, and 0.093, respectively). Tables 4 and 5 show the comparison of the winter and spring SCARED, CSI-24, and PedsQL scores for both CG and SG.

Discussion

This study investigated the impact of bee sting allergies on anxiety, somatization, and quality of life in children, with a particular focus on seasonal variations. The findings

Table 4 Comparison of winter and spring SCARED, CSI-24, and PedsQL scores of the study group.

Parameters	Winter (n = 53)	Spring (n = 53)	P
SCARED score	22 (1-47)	29 (0-52)	**0.003**
CSI-24 score	12 (0-38)	10 (0-31)	0.093
PedsQL scores			
Physical score	78 (22-100)	78 (28-100)	0.177
Emotional score	75 (30-100)	65 (25-100)	0.860
Social score	100 (45-100)	95 (40-100)	0.054
Academic scores	75 (35-100)	65 (35-100)	0.093

Notes: Values are presented as median (minimum-maximum). The Wilcoxon Signed-Rank test was used for within-group (winter vs. spring) comparisons.
PedsQL: Pediatric Quality of Life Inventory; CSI-24: Children's Somatization Inventory-24; SCARED: Screen for Child Anxiety-Related Disorders.

Table 5 Comparison of winter and spring SCARED, CSI-24, and PedsQL scores of the control group.

Parameters	Spring (n = 53)	Winter (n = 53)	P
SCARED score	14 (4-41)	14 (4-41)	1
CSI-24 score	6 (0-23)	6 (0-23)	1
PedsQL scores			
Physical score	90 (50-100)	90 (50-100)	1
Emotional score	90 (45-100)	90 (45-100)	1
Social score	100 (70-100)	100 (70-100)	1
Academic scores	85 (40-100)	85 (40-100)	1

Notes: Values are presented as median (minimum-maximum). The Wilcoxon Signed-Rank test was used for comparisons.
PedsQL: Pediatric Quality of Life Inventory; CSI-24: Children's Somatization Inventory-24; SCARED: Screen for Child Anxiety-Related Disorders.

revealed significant differences in psychologic and quality-of-life outcomes between affected and healthy children, and notable changes in these outcomes between winter and spring.

The significantly higher median SCARED scores in SG, compared to CG during winter emphasized the elevated anxiety experienced by children with bee sting allergies. This heightened anxiety was consistent with previous research highlighting the link between chronic allergic conditions and increased anxiety levels.[13] Oh et al. examined the relationship between seasonal allergies and psychiatric disorders in the United States and found that seasonal allergies were associated with increased odds of mood disorders, anxiety disorders, and eating disorders.[14] Similarly, our results emphasized the importance of screening individuals with seasonal allergies for early signs of mental health problems and providing appropriate referrals to specialized services. Increase in the SCARED scores from winter to spring within SG in the present study indicated that seasonal changes could exacerbate anxiety. This seasonal effect could be attributed to the increased frequency of insect stings during spring, potentially heightening anxiety related to the anticipation or actual occurrence of stings. These findings suggested that children with insect sting allergies might experience fluctuating anxiety levels in response to seasonal variations and highlighted the need for targeted interventions during peak allergen activity periods.

Our study observed significantly higher CSI-24 scores, indicating elevated somatization in SG, compared to CG. This finding aligned with the study conducted by Hassel et al.,[15] which assessed the psychometric profile, including somatization, in patients with drug intolerance or venom allergies. Hassel et al. reported that these patients had significantly higher somatization scores compared to the general population.[15] Similarly, Jensen et al. investigated the impact of eosinophilic esophagitis (EoE) on various psychosocial factors, including somatization, and found that pediatric patients with EoE also exhibited increased levels of somatization.[16] These findings underlined the impact of allergic conditions on somatization and reinforced the understanding that somatization could manifest as physical symptoms of psychologic distress. Consistent with our results, these findings reflected the impact of allergic reactions on physical symptoms, reinforcing the understanding that somatization could manifest as physical symptoms of psychologic distress. Although the spring scores showed a decrease in somatization symptoms for SG in our study, this decrease was not statistically significant (P = 0.093). This lack of significant seasonal variation suggested that while there might be some seasonal relief or adaptation, SG continued to experience a higher burden of somatic symptoms. The persistent higher median scores in SG highlighted the ongoing impact of allergic reactions on physical well-being, even as symptoms fluctuated with the seasons.

Quality of life, as measured by PedsQL, demonstrated interesting patterns. The SG consistently had lower scores across all domains (physical, emotional, social, and academic functioning) compared to CG during winter. These differences were statistically significant in most domains except for social functioning. These findings were consistent with the previous research.[17] A study conducted by Bollinger et al. examined the quality of life in children with food allergies and found that these children also experienced significantly lower quality of life in physical, emotional, and social domains compared to their peers without allergies.[18] Similarly, a study done by DunnGalvin et al. investigated the psychosocial impact of food allergies on children and their families.[19] They found that children with food allergies had significantly lower quality of life scores, particularly in emotional and social functioning, compared to healthy controls. These findings highlight a critical area of concern where allergic patients experience a considerably lower quality of life, particularly in physical and emotional well-being. This disparity may be linked to their higher anxiety and somatization levels, emphasizing the need for targeted interventions to address these psychologic and physical health challenges.

Comparing the winter and spring PedsQL scores within SG, we observed that physical and social functioning scores remained relatively stable, while emotional and academic functioning scores declined, although not all changes were statistically significant. The emotional functioning score decreased from 75 to 65 (P = 0.86), and the academic functioning score decreased from 75 to 65 (P = 0.093). These trends suggest potential seasonal effects on specific quality of life domains, possibly influenced by school-related stressors and emotional challenges that intensify with seasonal transitions.

This study has several limitations that should be considered when interpreting the results. First, the sample size was relatively small, comprising only 106 participants. A larger sample would enhance the generalizability of the findings and provide more comprehensive data across different demographic groups. Second, the study was conducted at a single institution, which may limit the applicability of results to other geographic locations or populations. Additionally, data collection was restricted to the winter and spring seasons, potentially overlooking the effects of other seasons. These limitations highlight the need for future research with larger and more diverse samples and a broader range of variables to enhance the understanding of seasonal effects on insect sting allergies and their psychologic and physiologic impacts.

Finally, the study revealed significant disparities in anxiety, somatization, and quality of life between both SG and CG, with SG exhibiting higher anxiety and somatization levels and lower quality of life across various domains. Seasonal comparison within SG indicated fluctuating anxiety levels and some decline in emotional and academic functioning. These findings emphasized the need for targeted interventions to address the specific psychosocial and physical health needs of pediatric patients, particularly those in SG, to improve their overall well-being and mitigate the adverse effects of anxiety and somatization. Future research should explore the underlying factors contributing to these seasonal variations and develop strategies to support these vulnerable populations effectively.

Conclusion

Children with bee sting allergies suffer significantly more anxiety, somatization, and a lower quality of life than

children without such allergies, according to this study. Furthermore, these psychologic and functional impairments change seasonally, with anxiety spiking in the spring when insects are more active. Despite seasonal fluctuations in somatization and quality of life that were not statistically significant, consistently high distress levels emphasized the chronic nature of allergic disease's impact. Integrating psychologic assessment and support into pediatric bee sting allergy care, particularly during peak seasons, is crucial, as these findings demonstrate. More research is required to understand how these seasonal effects work and develop customized interventions to address mental health issues in this vulnerable population.

Disclaimer

The views expressed in this manuscript are solely those of the authors and do not necessarily represent the official policy or position of their respective institutions.

Mandatory Disclosure on Use of Artificial Intelligence

The authors declare that no AI-assisted tools were used in the preparation of this manuscript. All references have been manually verified for accuracy and relevance.

Author Contributions

MÖ conceptualized and designed the study, supervised the data collection process, and authored the article. ZB, EÖ, and BÖE contributed to patient recruitment and data collection. MKG contributed to psychiatric assessments and the interpretation of psychological data. FT conceptualized and designed the study, supervised the data collection process, and contributed to the interpretation of the article and the review of the data.

Conflict of Interest

All authors confirmed that there was no conflict of interest that needed to be disclosed or any relationships or activities that required reporting.

Funding

This study was funded by the author, and no additional grants were received.

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