Vol. 4 No. 4 (2025)

Pakistan Journal of Medical & Cardiological Review

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

Online ISSN 3007-2387

Print ISSN 3007-2379

Hematological Findings in Hyper IgE Syndrome Patients from Hyderabad, Sindh, Pakistan

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Keywords: Hematological, High IgE, Hyderabad.

Received on 15 Sep 2025
Accepted on 05 Oct 2025
Published on 15 Oct 2025

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Abstract

Hyper IgE Syndromes (HIES) are uncommon primary immunological deficits that are typified by high serum IgE levels, eosinophilia, lung infections, recurring eczema, and skin abscesses. Because of their genetic origins, the two types that were first identified as separate illnesses now possess overlapping clinical features but show different symptoms and disease outcomes. Our study involved 100 patients with hyper immunoglobulin E syndrome (HIES) and elevated IgE, randomly selected from hospitals in Hyderabad, alongside 100 matched controls with no Hyper IgE history. A self-structured questionnaire was administered to gather data on sociodemographic characteristics and risk factors. Blood samples were taken for hematological assessment using a Hitachi Cobass 1000 auto-analyzer. Statistical analysis was performed using the student's t-test, ANOVA, and SPSS version 21, with a significance level of $p<0.05$ at a 95% confidence interval. The study results found that patients with Hyper-IgE Syndrome (HIES) were more likely to be students (37% vs. 19%), predominantly male (57%), and aged 5 to 25 (13%). Symptoms such as shortness of breath, skin rashes, pulmonary infections, and recurring eosinophilia were

more prevalent. Chest pain, seasonal allergens, and high fever were associated with HIES, while fast food intake did not affect patient status. Strong correlations were found between bacterial infections and ill health with HIES. Additionally, Complete Blood Count analysis revealed significantly higher levels of neutrophils, lymphocytes, and eosinophils in patients, indicating ongoing inflammation or infection. Study concluded that Patients with Hyper-IgE Syndrome (HIES) are mostly male (57%), aged 5 to 25, and often students (37%). Key symptoms include breathlessness, skin rashes, recurring eosinophilia, fever, seasonal allergies, and chest pain. While fast food does not significantly impact the condition, bacterial infections are linked to poorer health outcomes. Blood tests commonly show elevated neutrophils, lymphocytes, and eosinophils, indicating active infection or inflammation.

Introduction

The inherited tendency to create IgE antibodies in response to low-dose environmental stimuli, such as dust mites, pollen, and food allergies, is known as atopy. Atopic individuals frequently suffer from food allergies, asthma, atopic dermatitis (AD), and allergic rhinoconjunctivitis. [1, 2] the progression of atopic sickness is shown by allergic march. From birth, atopic infants may respond and become sensitive to allergens. Food allergies are typically detected after AD. Food allergies has a role in the etiology of atopic dermatitis and is present in the majority of its patients. Due to respiratory allergy sensitivity, the table covers bronchial asthma and allergic rhinitis (AR) in later life [3].The most common chronic conditions in children are allergic diseases. According to epidemiological data, allergy-related illnesses are increasing in both industrialized and developing countries as a result of changing environments and lifestyles. [2,4-6]. As a result, further allergy testing is required An early diagnosis aids in the best possible management of allergy disease. Children are first evaluated by primary care physicians. Some children may have signs of conjunctivitis and seasonal AR. Newborns who vomit frequently may have allergies. Choosing who, when, and how to conduct allergy diagnostic testing is part of this process. Hypersensitive reactions to certain allergens that start with immunological processes are known as allergies [7].IgE exacerbates allergic responses and inflammation [8]. Eosinophilia can happen in a number of ways. These consist of helminth infections, atopic diseases, asthma, and drugs.

Neoplasms and sensitivities [8]. Eosinophils and IgE have distinct effects on disease. Eosinophilia is a side effect of allergic asthma, which is brought on by IgE. Eosinophil percentage and total immunoglobulin E were assessed in a number of allergy disorders, other hematological disorder may also be related to HIES. Hence present study was aimed to explore the relation of HIES with hematological and to know about the risk factors, we introduce present study pulmonary infection, smoking, Eczematoid, urticarial, breath shortness, severity at night, cough, high fever, chest infection, stress, bacterial infection, poor health, food allergy, meet, fish, egg, dust, and home in polluted area are the risk factors for HIES, whereas, Eosinophilia and Lymphcytopenia are also very common in HIES patients

Materials and Methods:

Study Design:

This cross sectional research ran from January to December of 2024. Five well-known hospitals in Hyderabad and the surrounding areas were selected from their outpatient departments to investigate the origin, 100 (N=100) HIES patients and 100 controls were randomly selected with matched geography and gender after obtaining a signed written informed consent from each participant. A self-structured questionnaire was created

especially to examine the socio-demographic characteristic and risk factors associated with HIES.

Specimen Collection and Questionnaire:
In an effort to find patterns linked to HIES, 5ml blood samples taken in an EDTA and yellow top tube. The data was examined for differences in hematological parameters utilizing automated hematology analyzers and immunoassay techniques. A standardized questionnaire was used to collect clinical, demographic, lifestyle, and environmental data from Hyper IgE Syndrome patients in Hyderabad, Sindh, Pakistan, to identify potential risk factors.

Ethical Consideration:
The University of Sindh, Jamshoro's Ethical Review Committee examined the study protocol, informed consent forms, and questionnaire and approved the study via letter no # IOB/07/2019 dated -03/01/2019

Statistical Analysis
The Microsoft Excel 2017 computer program was used to compile and process the data. The risk factors were determined by calculating the odds ratio. The reference was exhibited normal features which indicated OR = 1 (means no association) OR > 1 mean positive association and OR < 1 means negative association with HIES.

Results:
The comparison of HIES patients and controls in Table 1 revealed that although the age distribution varied slightly, men were more common (57%). 26 to 45 years age group was more prevalent for HIES, students were more in number in HIES to controls.

Table 1: Socio-demographic characteristics

Characteristics	HIES Patients (n=100)	Controls (n=100)
Gender		
Male	57	43
Female	43	57
Age Groups		
5-25 years	33	28
26-45 years	44	56
46-65 years	18	12
>66 years	5	4
Occupation		
Housewife	25	21
Student	37	19
Labor	7	7
Child	2	13
Private Employee	10	18
Govt. Employee	20	20

Table 2. Association of some clinical, dietary and environmental factors with HIES are present eosinophilia, pulmonary infections, skin-related symptoms, and shortness of breath among patients and control groups. Patients had a significant association of recurrent eosinophilia, pulmonary infections with HIES, urticarial red skin rashes, and shortness of breath. Furthermore Seasonal allergies, high fever. Bacterial infections and

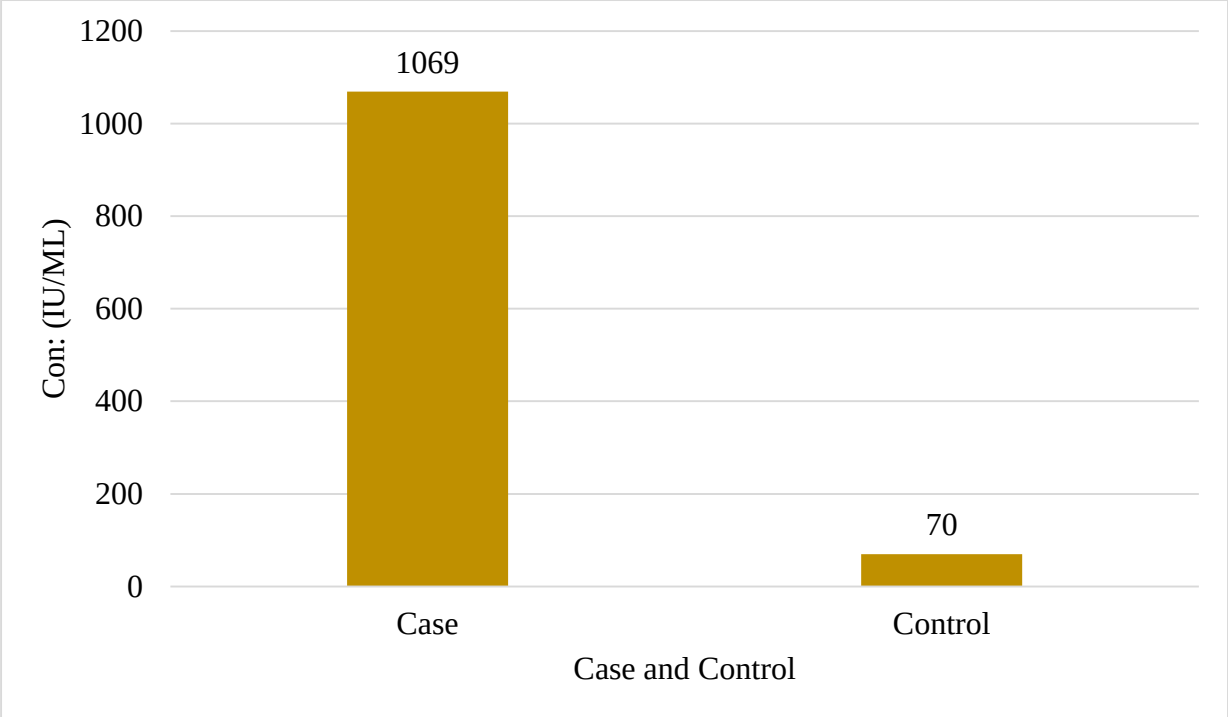
poor health were significantly associated with HIES. Whereas, good health was significantly inversely associated with the disease

Table 2.0 Association of clinical factors with Hyper Immunoglobulin E

Risk factor	Patients	controls	OR(95%CI)	P value (<0.05)
Recurrent Eosinophilia	60	12	11.00(5.33 -22.689)	0.000
Pulmonary infection	78	21	16.0(8.015-32.092)	0.000
Eczamatoid	12	3	4.4(1.204- 16.140)	0.029
Urticarial red skin rashes	55	17	5.967 (3.103-11.4790	0.000
Shortness of breath	79	38	6.138(3.275- 11.503O	0.000
Condition serve at night	87	32	2.719 (0,991 -7.456)	0.056
Seasonal allergy, cough	63	16	10.89(5.467 -21.708)	0.000
Condition in Cold	9	9	1.00 (Reference)	
High fever	70	16	12.25 (6.177-24.293)	0.000
Chest pain	64	15	51.3(18.864-139.892)	0.000
Stress	55	20	4.88 (2.60 – 9.16	0.537
Fast food	34	46	0.605(0.342-1.070)	0.112
Bacterial infection	13	5	4.481(1.503-13.357)	0.009
Poor health	48	3	14.08(4.096 -48.401)	0.00
Good health	2	47	0.037(0.009-0.163)	0.000

A substantial association Patients with elevated IgE levels and the disease, possibly contributing to its pathophysiology, is suggested by the data presented in Figure 1.which shows a significant difference in IgE levels between the case and control groups, with the case group having significantly higher levels at 1069 IU/ML were included in present study

Figure 1.0 shows the IgE level



In table 3.0, we analyzed the hematology of the patients and controls and noted variations. In patients the red blood cell count was somewhat greater, and the hematocrit and hemoglobin levels were slightly higher. Hemoglobin concentration and mean corpuscular volume did not differ significantly. The case group showed slightly higher WBC counts than controls, but no significant difference. All the other Platelet counts were similar, but differential counts showed significant immune cell profile deviations. Neutrophils, lymphocytes, and eosinophils were significantly elevated in cases compared to controls, indicating an ongoing inflammatory or infectious process. These findings suggest immune system activation or response, possibly due to allergies or eosinophilic components. The data suggests that neutrophil, lymphocyte, and eosinophil levels may serve as key hematologic indicators in the patient group, despite general blood parameters remained stable.

Table 3.0 Comparison of Complete Blood Count (CBC) Parameters between Cases and Controls

CBC parameter	Case (n=100) Mean ± SD	Controls (n= 100) Mean ± SD	p-Value <0.05
RBCs	4.85±5.36	4.62±0.64	0.007
WBCs	10.32±9.77	9.58±4.33	0.49
Platelets	286.16±99.66	284.75±135.31	0.93
Haemoglobin	12.72±1.87	12.43±2.07	0.29
Heamotocrit	39.72±4.80	38.45±5.36	0.08
MCV	82.50±8.39	83.37±8.89	0.47
MCH	26.49±3.28	27.02±3.11	0.29
MCHC	35.08±31.32	32.33±2.11	0.38
Neutrophils	59.78±13.95	54.36±13.17	0.005
Lymphocytes	34.93±10.80	27.69±12.70	0.007
Monocytes	7.40±2.31	7.89±3.81	0.30
Eosinophls	4.40±4.21	2.82±2.69	0.001
Basophils	0.47±0.27	0.40±0.25	0.07

Discussion:

As indicated in table -1 male patients are prominently higher, Another study found a male predominance among Hyper-IgE Syndrome (HIES) patients (57%), indicating a higher as incidence of primary immune deficiencies in males due to X-linked genetic patterns [9]. Our study also found a significant presentation 26-45 years age group in the patient group (44%) compared to controls (56%), which is in contrast with Pakistan's general pediatric admission trends. This could be due to delayed diagnosis or lack of awareness [10]. Our study found a high proportion of students among HIES patients (37%), possibly due to adolescent symptoms or access to educational environments have worsen their condition (table-1) due to allergy. Other Pakistan study shows the informal sector workers, laborers, and agricultural workers are more affected by health disparities due to poor working conditions and limited care access, which is not comparable with present study [11]. The study reveals that patients with Hyper-IgE Syndrome HIES in Pakistan have a higher prevalence of recurrent eosinophilia, pulmonary infections, eczematoid conditions, urticarial red skin rashes, and shortness of breath compared to controls (table -2) Symptoms are more pronounced at night, and seasonal allergies and high fever are strongly associated with the condition [12]. Global studies on HIES consistently show elevated eosinophil counts, increased pulmonary infection susceptibility, skin conditions like eczema and urticaria, nocturnal

exacerbation, seasonal allergies, and high fever in HIES patients [13]. Our study on primary immune deficiencies in Pakistan aligns with previous research, but the higher prevalence of certain symptoms may indicate regional variations in healthcare access and diagnostic capabilities [14]. The study's findings suggest that genetic and immunological factors are more significant in the pathogenesis of HIES, despite the lack of significant association with stress and dietary factors.

Our study analyzes hematological parameters in patients with Hyper-IgE Syndrome, revealing elevated WBC counts, suggesting an active immune response, potentially indicating inflammation or allergic reactions.(Taable-3) In comparison with other study Batool et al.'s 2022 study found leukocytosis in 46.2% of pulmonary tuberculosis patients, with elevated WBC counts, but further research is needed to understand differential leukocyte counts in HIES patients [15]. Another study Mazhar et al.'s 2021 study found elevated WBC counts in healthy adults across Pakistan, suggesting they may serve as potential biomarkers for immune system activation in HIES patients [16]. Akhtar et al.'s 2022 study found thrombocytopenia in 34.1% of aplastic anemia patients, while our study found stable platelet counts in HIES patients, contrasting their hematological profiles [17].

CONCLUSION:

This study concludes that many immunological deficits have a hereditary foundation due to the frequency of Hyper-IgE Syndrome (HIES) in Pakistan, which is shown to be male (57%). The underrepresentation of youngsters (2%) is alarming because it could be the result of ignorance or a delayed diagnosis. A higher likelihood of symptom onset during adolescence or simpler access to healthcare may be indicated by the high percentage of students (37%) among HIES patients. Shortness of breath, skin disorders, lung infections, and recurring eosinophilia are some of the main characteristics of HIES. Stable platelet levels contrast with thrombocytopenia in situations of aplastic anemia, but elevated WBC numbers indicate continued immunological activation. The study emphasizes the need for better pediatric screening, more diagnostic awareness, and a better comprehension of the immunological underpinnings of the illness.

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