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ELEVATED SERUM IMMUNOGLOBULIN E LEVELS AMONG SCHOOL CHILDREN IN PERAK, MALAYSIA – COULD HAZE HAS PLAYED A POSSIBLE ROLE AS AN ENVIRONMENTAL FACTOR?

Ramachandran Vignesh¹, Tharam Sadanandam², Noor Hasni Emjah¹, Vivekanandan Gopalakrishnan*¹

¹Laboratory-based department, Faculty of Medicine, UniKL- Royal College of Medicine Perak (UniKL-RCMP), Universiti Kuala Lumpur, Ipoh, Malaysia.

²Medicine-based department, Faculty of Medicine, UniKL- Royal College of Medicine Perak (UniKL-RCMP), Universiti Kuala Lumpur, Ipoh, Malaysia.

Email: gopalakrishnan@unikl.edu.my

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Abstract:

Background: In Malaysia, there have been high prevalence of allergic diseases and parasitic infections reported. This study was designed to assess the serum IgE levels and blood eosinophil counts in school children from an urban community of Malaysia. The study also aimed to investigate the possible temporal relationship between these values and geohelminthic infestations.

Materials and Methods: From 33 school children of age 10 to 11 years from Kinta district of Perak, blood and stool specimens were collected. Differential blood counts and serum IgE estimation were made from blood specimens and complete parasitological screening performed on stool specimens.

Results: When compared with the normal reference ranges, the study participants' median Ig E levels were found to be unusually higher. It was also noted that the median IgE level was higher in males compared to females, though this difference was not statistically significant. The eosinophil counts of all the participants were observed to be normal and interestingly, all the stool specimens tested were negative for geohelminths. Also, no correlation was observed between the IgE levels and the eosinophil counts.

Conclusion: The results of this study corroborate with the hypothesis of inverse relationship between high IgE levels and presence of parasitic infections. It could be possibly extrapolated that this elevated levels of IgE observed in the study population are attributed to the haze that occurred in Malaysia in 2015.

Keywords: Allergy, Eosinophil, IgE, Geohelminth, Parasites

Introduction:

It is estimated that worldwide over 130 million people suffer from asthma and other allergic diseases and the prevalence is increasing mainly in developed countries(1). Studies have reported the association between the elevated levels of total serum immunoglobulin E (IgE) and development of asthmatic and allergic diseases in children(2). Several studies have demonstrated that the allergic diseases are rare in areas with high helminth parasite exposure and common where helminth exposure is lacking or significantly reduced, such as urban areas of developing countries and industrialized nations(1,3,4). In Malaysia, the prevalence of allergic diseases have been reported to be high and in addition, parasitic infections, including helminth parasites are also highly prevalent(5–7). Malaysia is also home to the other environmental factors that induce allergic diseases such as air pollution and exposure to smoke.

Materials and Methods:

Hence, we set out to assess the total serum IgE and eosinophil count in a random sample of school children between 10 and 11 years of age in an urban community of Perak state, Malaysia, and also investigate a possible relationship between these values and helminthic parasite infestation. The study was approved by the ethical committee of Universiti Kuala Lumpur and following full explanation of procedures to the parents and taking a written consent, school children (n=33) aged 10 to 11 years from Kinta district, Perak state were included. About 5 mL of blood was collected for differential blood counts and serum IgE estimation.

Stool specimens were also collected from the study participants for complete parasitological screening by microscopy following standard methods. Differential blood counts were measured using automated blood analyzer and serum IgE levels were measured by a quantitative ELISA. A questionnaire to collect information on the demographics and clinical history of the study participant was also sought.

Results:

The study participants (n=33) were in the age group of 10 to 11 years of whom 57.5% (19) were males and the remaining females. Table I represents the median values of hematological parameters and table II lists the median differential blood count values. The median Ig E level among the study participants was 360 IU/mL(IQR 147.8, 1303 IU/mL) which is unusually higher than the normal reference range of <90 IU/mL. Almost 76% of the children showed an IgE value of more than 100 IU/ml, and about 36% had values of more than 1000 IU/mL. Interestingly, 2 participants (6%) had IgE

levels was elevated over the upper limit of detection (>2500 IU/mL). The median IgE level was higher in males (867.3 IU/mL) compared to females (292.9 IU/mL), though these values were not statistically significant ($p=0.71$). The median value for eosinophil in differential count was 4% (interquartile range 2, 6) and all the participants had eosinophil counts within the normal limits. There was no correlation observed between the IgE levels and the eosinophil counts. The stool parasite analysis revealed that there were no parasites observed in all the stool specimens collected and pus cells or RBCs were absent in the stool specimens.

Table I. Median values of the haematology investigations of the study participants.

Parameter - units	Median values (Interquartile ranges)	Reference ranges
Haemoglobin (Hb) – g/dL	13.3 (12.9, 13.8)	10.5 – 14.5
Red cell count (RCC) - x 10 ⁶ /mm ³	5 (4.7, 5.2)	4.0 – 5.2
Red cell distribution width (RDW) - %	13	<16
Packed cell volume (PCV) - %	0.38 (0.37, 0.39)	0.35 – 0.42
Mean cell haemoglobin (MCH) – pg	27 (26, 29)	25 - 33
Mean cell volume (MCV) - fl	77 (76, 79)	77 – 95
Mean cell haemoglobin concentration (MCHC) – g/dL	350 (340, 360)	310 – 360
Platelet count - x 10 ⁹ /L	368 (335, 423)	150 – 450
Total white cell count (Total WCC) - x 10 ⁹ /L	8.5 (7.1, 9.2)	4.2 – 12.6

Table II. Median values of differential counts of the study participants.

Differential counts (%)	Median values (Interquartile ranges)	Reference ranges
Neutrophils	47 (43, 58)	32 – 60
Lymphocytes	42 (28, 47)	34 – 45
Monocytes	6 (5, 8)	1 – 8
Eosinophils	4 (2, 6)	2 – 10
Basophils	0 (0, 1)	0 – 2

Discussion:

While a few studies have demonstrated the positive association and several studies the inverse association between the elevated IgE levels and the presence of geohelminth infections, (3,4,8) the current findings support the inverse relationship hypothesis. In Malaysia, haze is caused by both domestic and open biomass burning and peat fires from neighboring countries is an annual phenomenon. This leads to deterioration of air quality and the recent transboundary haze that lasted from August to end of October 2015 was the longest. Several studies have assessed the impact of haze on the health of school children and general population in Malaysia.(9–11). The elevated levels of IgE while other parameters remaining normal could also be attributed to this haze. A similar study in Spain, assessing the levels of IgE in healthy children also observed elevated levels in those living in air-polluted areas than those in less polluted areas(12).Low sample size is one of the limitations of the study and a detailed study with more sample size and additional parameters would be required to confirm the causal relationship.

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Corresponding Author:

Vivekanandan Gopalakrishnan*,

Email: gopalakrishnan@unikl.edu.my