

# Correlation Between Prevalence of Allergic Rhinitis and Certain Diseases

**Mini Review****Abstract**

Allergic rhinitis is the most common chronic inflammatory disease of the upper respiratory tract, and its symptoms include watery rhinorrhea, sneezing, itching and nasal congestion. There have been quite different results for the prevalence of allergic diseases in different parts of world detected by surveys. However more amazingly, the international patterns of allergic disease prevalence cannot be explained by the current perception of the etiology of these conditions. Differences have been usually thought to be due to genetics, hygiene, diet, and environmental factors and not to be related to simply increased awareness of the disease. When current literature searched in detail, some of well-known specific diseases seem to be risk factors affecting development of allergic rhinitis. In this mini review, our aim is try to explain whether any relation between increasing allergic rhinitis prevalence and some specific disorders under the light of recent literature.

**Keywords:** Allergic rhinitis; Hyperbilirubinemia; Kawasaki disease; Convulsion; Attention deficit hyperactivity disorder

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**Öner Özdemir\* and Bahri Elmas***Department of Pediatrics, Research and Training Hospital of Sakarya University, Turkey*

**\*Corresponding author:** Öner Özdemir, Division of Allergy and Immunology, Department of Pediatrics, Faculty of Medicine, Sakarya University, Research and Training Hospital of Sakarya University, Adnan Menderes Cad, Sağlık Sok. No: 195 Adapazarı, Sakarya, Turkey, Tel: + 90-(264) -444 54 00; Fax: +90-(264) -275 91 92; Email: ozdemir\_oner@hotmail.com

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**Abbreviations:** AR: Allergic Rhinitis; ISAAC: The International Study of Asthma and Allergies in Childhood; KD: Kawasaki Disease; ADHD: Attention Deficit Hyperactivity Disorder; HRs: Hazard Ratios; OR: Odds Ratio; CI: Confidence Interval

## Introduction

Here in this mini review, our aim is try to explain whether any relation between increasing allergic rhinitis (AR) prevalence and some old well-known specific disorders under the light of current literature at the present time.

## Allergic rhinitis and its prevalence

AR is the most common chronic inflammatory disease of the upper respiratory tract, and its symptoms include watery rhinorrhea, nasal congestion, sneezing and itching. Frequently, its symptoms can also involve the eyes, ears, and throat [1]. Similar to other allergic diseases, as the prevalence of AR has been increasing nowadays, the International Study of Asthma and Allergies in Childhood (ISAAC) and other surveys were developed in 1991 to investigate childhood AR and other allergic diseases at the population level. ISAAC has instantly drawn worldwide interest and large-scale involvement facilitating international cooperation [2-4].

## Allergic rhinitis prevalence rates

ISAAC phase I questionnaire was designed to evaluate and to compare prevalence and risk factors for AR and other allergic diseases in children from different countries and centers thru the world [5]. ISAAC Phase I study involved over 700.000 children of two age groups, 13-14 years and 6-7 years, from 156 centers in 56 countries. ISAAC Phase I studies demonstrated that there are large variations (differences of between 20- to 60-fold among centers) in the AR prevalence throughout the world. The prevalence of childhood AR ranges from 0.8% to 45.1% worldwide. Recent global estimates indicate that approximately 8.5% of children aged 6 to 7 have AR, and the prevalence rate (14.6%) is higher

among 13 to 14 year olds [2-4].

There have been quite different results reported in the prevalence of allergic diseases in different parts of world detected by using ISAAC questionnaires. Even the variation among districts of the same city in the prevalence of AR has been found to be very high. In developed western parts of world, the prevalence of AR and other atopic diseases were usually higher than other parts of world. And similarly the prevalence in urban areas is higher than that of rural areas [2-6]. Perhaps more importantly, these studies show that the international patterns of disease prevalence cannot be explained by the current understanding of the etiology of these conditions [7].

## Risk factors affecting development of allergic rhinitis

Differences have been thought to be due to mainly genetic (a positive family history of atopy), hygiene, diet, and environmental factors and not to be related to simply increased awareness of the disease [8]. Nonetheless when current literature searched in detail, some well-known old specific diseases seem to be affecting risk factors in the development of AR.

## Effect of some specific disorders as risk factors for the development of allergic rhinitis

In here, four specific diseases / disorders (neonatal hyperbilirubinemia, febrile convulsion, Kawasaki disease and attention deficit hyperactivity disorder) and their probable relation with AR as risk factors are discussed under the light of very current literature.

## Neonatal jaundice

Studies have reported a probable link between neonatal hyperbilirubinemia and/or neonatal phototherapy and childhood allergic diseases. But, only a few studies have systemically investigated the association between neonatal jaundice and childhood AR. Sun et al evaluated 11.328 children, from birth up to 10 years of age, collected from the National Health Insurance

Research Database in Taiwan. After adjustment for the confounding factors, the odds ratio (OR) s of AR was higher in icteric children (OR: 1.46; 95% CI, 1.24-1.72). This difference was thought to be due to frequent use of oral antihistamines as well as higher incidence of lower respiratory infection, sinusitis and otitis media rates in the icteric children. However, there was no association found between neonatal phototherapy and pediatric AR [9]. In another study by Wei et al, from 2000 to 2007, 27.693 neonates with newly diagnosed neonatal jaundice and 55.367 matched non-neonatal jaundice cohorts were studied. The incidence density and hazard ratios (HRs) of the AR were greater in the neonatal jaundice cohort than in the non-neonatal jaundice cohort. The HRs for AR (2.51; 95% CI, 2.43-2.59) was one of the highest in allergic diseases. The HRs of allergic diseases was substantially greater for boys and in whom requiring phototherapy. The HRs of the allergic diseases was not significantly different between the neonatal jaundice regardless of whether the patients received exchange transfusion [10]. In addition, a systematic review by Das et al. from 79 citations included a total of 7 good quality studies (n: 101.499) in the final analysis. There was a significant increase in the odds of AR after neonatal hyperbilirubinemia (OR: 5.37; 95% CI, 4.16-6.92) and after neonatal phototherapy (OR: 3.04; 95% CI, 2.13-4.32) [11]. In summary; neonatal jaundice and neonatal phototherapy seem to increase the rate and complications of childhood AR and may be a risk factor for childhood AR.

### Febrile convulsion

The relationship between febrile convulsions and AR has not been previously known well. An article by Lin et al sought to explore the association between these two disorders by collecting data from the Taiwanese nationwide cohort database. A total of 1.304 children with febrile convulsions were enrolled as the case cohort, and controls were matched based on age, sex, urbanization levels, and parents' occupation. During an approximate 6.7 years follow-up period, the incidence of AR in the febrile convulsions group was higher (65 vs. 51/1.000 person-years). After 11 years of follow-up, the AR incidence in the febrile convulsion patients was approximate 4% higher than controls. Risk of AR in the febrile convulsions group was found to be 1.21 (95% CI, 1.08-1.36) times higher than in the control group. The risk of AR development is further increased with frequency of febrile convulsion-related medical visits (1-3 visits vs. >3 visits). This nationwide population-based retrospective cohort study showed the relation between febrile convulsion and AR prevalence in children. Children with > 3 febrile convulsion-related medical visits were shown to have a significantly higher AR cumulative incidence. Since similar cytokine profiles and association with specific viral infections in both disorders during an episode of febrile convulsion have been detected, these parallel etio-pathogenetic mechanisms could somewhat explain this increased risk [12].

### Kawasaki Disease (KD)

KD is the most common acquired heart disease among preschool children in most developed countries. An atopic tendency after KD has been reported in epidemiological studies. This atopic predisposition is compatible with the findings of increased IgE and IL-4 serum levels in KD patients. Nonetheless the risk of allergic diseases among KD patients in comparison to the general population is not known. In a population-based matched cohort study by Kuo et al aimed to investigate the risk

of allergic diseases among children after KD in Taiwan, which is a country with the third highest incidence of KD in the world. Data were gathered from the Taiwan National Health Insurance Research Database. 253 patients, ≤5 years of age, had a first-time hospitalization with a diagnosis of KD between 1997 and 2005 were included as the study cohort. 1.012 non-KD patients matched for age and sex were included as comparison cohort. The incidence rate of allergic diseases (185/1.000 person-years) was significantly higher in the KD cohort than in the control cohort (125/1.000 person-years). After adjusting for potential confounders, the adjusted HR for AR was 1.30 (95% CI, 1.04-1.62). They concluded that KD patients are at an increased risk for developing allergic diseases corresponding to the comparison cohort [13]. Another study by Tsai et al aimed to evaluate the association between KD, AR and allergic diseases from infancy to school age. During the first 5 years of life, children with KD had more AR (OR: 1.30; 95% CI, 1.22-1.38) than controls. Children having KD were considered to have a higher allergic susceptibility recognized from their infancy and the atopic tendency persists until school age [14].

In a sibling control study, Liew et al. [15] hypothesized that children who had KD have a lower risk of developing allergic diseases. Because, KD is a multisystem inflammatory vasculitis of childhood with extensive Th1 type immune activation. 186 children (93 KD sibling pairs) were evaluated. AR was more common in patients with KD (OR: 2.40; 95% CI, 1.11-5.62) when compared with controls. Children in whom KD occurred beyond the age of 12 months had more AR (OR: 4.00; 95% CI, 1.29-16.44), corresponding to their sibling controls. Interestingly, children in whom KD caused no coronary artery abnormalities have also more AR (OR: 8.50; 95% CI, 2.02-75.85). The authors assumed that KD happens more frequently in children at risk of immune disequilibrium, with an abnormal inflammatory response in the beginning, and consequently more allergic manifestations [15-17].

### Attention deficit hyperactivity disorder (ADHD)

Both allergic diseases and ADHD are common pediatric disorders leading to mental and physical discomfort. Typical AR symptoms can cause daytime inattention, irritability, and hyperactivity, which are also features of ADHD. A hypothesis for ADHD is assumed based on examination of the physiopathologic mechanisms underlying the development of ADHD and allergic diseases. ADHD may comply with the current criteria of hypersensitivity, atopy and allergy. Some authors consider it as a non-allergic hypersensitivity disorder [18]. Yet contradictory data in previous studies suggest regarding the association between ADHD and AR. The aim of a population-based study by Chou et al was to examine the prevalence and AR risk in ADHD patients in Taiwan. They performed a cross-sectional study by utilizing the National Health Insurance Research Database in Taiwan. The study subjects included 469 patients who received psychiatric care for ADHD in 2005 and the general population (n: 220.599). The AR prevalence in ADHD group and the general population was 28.4 and 15.2%, respectively. The multivariate logistic regression analysis showed that ADHD patients had an increased AR rate than general population (OR: 1.83; 95% CI, 1.48-2.27) [19].

In another population-based case-control study by Tsai et al. [14] was designed to correlate the risk of ADHD with allergic

diseases in a pediatric population. From a Longitudinal Health Insurance Database ranging from 2002 to 2009, 4.692 children with ADHD and 18.768 randomly selected controls were enrolled into this study [14]. The children with ADHD were detected to have a higher rate of allergic diseases than controls, particularly AR (OR: 1.81; 95% CI, 1.69-1.93) and allergic conjunctivitis (OR: 1.69; 95% CI, 1.58-1.81) [20]. Therefore, assessment of allergic sensitization may be beneficial in children diagnosed with ADHD [21]. And evaluation and treatment of AR could benefit patients with ADHD [22]. As a result, besides allergists psychiatrists should be more aware of the co-morbidity of AR when treating ADHD patients.

## Conclusion

Awareness of the relation between these specific diseases/co-morbidities and AR may help clinicians e.g. allergists-immunologists to provide better comprehensive management and lessen the burden of disease.

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