

## FACTORS RELATED TO THE INCIDENT OF ALLERGIC RHINITIS IN CHILDREN IN DENPASAR

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## ABSTRACT

**Background:** Allergic Rhinitis (AR) is an inflammation of the lining of the nasal mucosa accompanied by a hypersensitivity reaction to allergen exposure, showing symptoms such as nasal congestion, runny nose, itching, and sneezing. Controlling AR is very important given its high prevalence and impact on children's lives. AR in children is often left untreated, leading to complications such as asthma and sinusitis. Factors associated with AR involve internal aspects such as gender and genetic factors (family history of atopy), as well as external factors such as exposure to cigarette smoke and the presence of furry animals. Denpasar, as the capital of Bali, faces a unique environmental challenge with major pollution, including cigarette smoke, and the highest dog ownership rate in Indonesia. The lack of research on the factors of AR in children, especially in Denpasar, necessitates the identification of these factors. Understanding these factors is key to the effective control of AR, given its impact on children's social lives and school performance. **Objective:** To determine the factors associated with the incidence of AR in children in Denpasar. **Method:** This study is an analytic observational study using a cross-sectional design. The study was conducted on children aged 13-14 years in Denpasar. Data collection used the Stratified Random Sampling technique with alpha 1.96 and beta 0.842, resulting in a minimum sample of 122 samples. The data were analyzed using the Chi Square test with the help of SPSS (Statistical Program for Social Science) software. **Results:** The research subjects were 236 children aged 13 years and 14 years. A total of 170 children (72.04%) had experienced AR. AR in children aged 13-14 years is more common in girls (72.5%; IK 95% = 0.753-1.410; P = 0.853). There were 71 children who experienced AR with a family history of atopic disease (85.6%; IK 95% = 0.253-0.748; P = 0.001). There were 112 children who had AR and kept furry pets (73.2%; IK 95% = 0.759-1.172; P = 0.587). 85 children experienced AR and were exposed to cigarette smoke (82.6%; IK 95% = 0.358-0.832; P = 0.002). **Conclusion:** Risk factors that have a significant relationship to AR in children in Denpasar in 2023 are a family history of atopy and exposure to cigarette smoke.

**Keywords:** Allergic Rhinitis., Risk Factors., Pediatric

## INTRODUCTION

Allergic rhinitis (AR) is an inflammation of the nasal mucosa accompanied by a hypersensitivity reaction due to allergen exposure that involves several typical symptoms consisting of nasal congestion, runny or watery nose (rhinorrhea), nasal itching, and sneezing.<sup>1</sup> In recent decades, allergic rhinitis has become a global health problem. At least 10-25% of the population has the disease worldwide and its prevalence is increasing. Children with allergic rhinitis can experience various physical, as well as social activity disorders and feel mentally unwell. Schuler IV states that the typical reported incidence of AR is between 10% of children in the United States and other developed countries. In fact, special surveys regarding reports of AR diagnosed by doctors are around 13% in children. Most individuals experience the development of AR symptoms before the age of 20 years, with almost half of these patients starting symptoms at the age of 6 years.<sup>2,3</sup>

In Indonesian region, a study was conducted by ISAAC phase three in several regions to determine the prevalence of AR using a questionnaire. From the results of the study obtained in Jakarta, 26.71% of children aged 13-14 years experienced symptoms of AR. Whereas in Bandung and Semarang, the prevalence of AR in children aged 13-14 years amounted to 19.1% and 18.4%.<sup>4</sup> The classification of AR according to the World Health Organization - Allergic and Rhinitis on Its Impact on Asthma (WHO-ARIA) is based on the duration and degree of symptoms. Duration of symptoms consists of intermittent and persistent. Meanwhile, according to the degree of symptoms, AR is considered mild if there is no disturbance during sleep, interference with daily activities, in relaxing, doing sports, in studying and working. Included in moderate-heavy if one or more of the above disorders are experienced. With the high prevalence potential of AR and with the relationship between the incidence of AR and children's lives, it is important to control AR. AR that is not controlled properly will interfere with daily activities. Based

on the data and description above, AR is a disease that seems trivial but turns out to be quite disturbing and is suffered by quite a lot of children, but in Indonesia there are still few studies conducted on AR, especially in children.<sup>5</sup>

Although in general AR is not a serious disease, it can have an impact on the social life of sufferers and also their performance at school. Despite the high prevalence of RA, it is often inadequately managed, especially AR in the pediatric population. The causes of inadequate and inadequate management of AR include ignorance or inaccuracy of the causes or factors that are significantly associated with its occurrence.<sup>6</sup> In addition, AR that is not treated properly can cause worsening of asthma for people with allergic rhinitis who also suffer from asthma, sinusitis due to blockage in the nasal cavity, and middle ear infections or otitis media.<sup>7</sup> Therefore, controlling rhinitis must begin with recognizing various factors associated with the occurrence of allergic rhinitis in children.<sup>8</sup>

According to previous studies, factors that are often associated with the incidence of AR include internal factors, namely age, gender, genetics (parental history with atopic) and external factors, namely furry pets and cigarette smoke.<sup>9</sup> Denpasar City is the capital of Bali province which is also one of the most crowded city centers in Bali. Denpasar has natural and cultural beauty that characterizes it. Bali's natural and cultural beauty makes Bali one of the tourist destinations including Denpasar City. Denpasar has a more advanced tourism industry when compared to its manufacturing industry, so the number of large factories in Denpasar is not as much as in other big cities. This makes the main source of pollution in Denpasar mostly from motor vehicles. Another source of pollution is from cigarette smoke, where cigarette use in Bali is the third highest in Indonesia. In addition, Bali, including Denpasar City, has the highest level of furry animal maintenance, namely dogs, in Indonesia.

The different aspects of the environment that play a significant role allow factors associated with the incidence of AR in Denpasar may have a different level of influence compared to other cities in Indonesia. There has never been a report on factors associated with allergic rhinitis in children, especially in Denpasar. Therefore, the author was encouraged to conduct this study to determine the factors associated with the occurrence of allergic rhinitis in children, especially in Denpasar.<sup>9,10</sup>

## MATERIALS AND METHOD

This research design uses the cross-sectional method. In a cross-sectional study, independent variables are sought first and at the same time dependent variables are assessed at one time. The independent variables of this study are gender factors, genetic factors (atopic parental history), furry pet factors, and cigarette smoke factors. The dependent variable in this study was allergic rhinitis.

The target population in this study were children aged 13-14 years at SMP Tunas Daud and SMPN 10 Denpasar from June to October 2023. Complete information about the research was given to the school first and then announced to students and parents of the research subjects. The study continued by giving the research subjects informed consent and signing it to ask for willingness to become research subjects. After agreeing, the subjects will fill out the questionnaire sheet consisting of the ISAAC questionnaire and risk factors independently. The completed questionnaires will be collected, and the characteristics and variables of the study will be recorded. Furthermore, the data will be analyzed using SPSS software.

The data collected will be analyzed analytically based on factors influencing the incidence of allergic rhinitis in children aged 13-14 years at SMP Tunas Daud and SMPN 10 Denpasar. Data will be processed using the Chi Square test with software assistance in the form of SPSS (Statistical Program for Social Science). Presentation of data on subject characteristics will be presented in tabular form. Categorical data will be expressed in frequency distribution and percentage. Bivariate analysis was performed using the chi-square method by cross tabulating to find the relationship between the independent and dependent variables. To assess the effect, the Prevalence Ratio (PR) was calculated with the following interpretation:

a)  $PR > 1$ , then the independent variable is a risk factor for the occurrence of AR

b)  $PR < 1$ , then the independent variable is a protective factor for the occurrence of AR

c)  $PR = 1$ , then the independent variable is not associated with the occurrence of AR

Then, the results of bivariate analysis that have a p value  $< 0.25$  are continued with multivariate analysis. Multivariate analysis was performed using logistic regression test.

The Research Ethics Committee of the Faculty of Medicine, Udayana University, has approved this research based on the ethical licence letter number 709/UN14.2.2.VII.14/LT/2023.

## RESULTS

This study found that the research characteristics were male gender is 105 children, children with a history of atopic parents is 83 children, children with a history of keeping furry pets is 153 children, and children with a history of exposure to cigarette smoke is 103 children. This study obtained the results of 236 children aged 13-14 years of the incidence of AR found in 170 children in Denpasar city or in other words the prevalence of AR in children aged 13-14 years in Denpasar was 72%. The characteristics of the research subjects can be seen in Table 1.

**Table 1.** Characteristics of Research Subjects

Variable	Number N = 236
Gender, n (%)	
Male	105 (44.5)
Family history of atopic disease, n (%)	
Yes	83 (35.2)
Furry pet, n (%)	
Yes	153 (64.8)
Cigarette smoke exposure, n (%)	
Yes	103 (43.6)
Allergic rhinitis, n (%)	170 (72.0)

Bivariate analysis of factors associated with the incidence of AR in children in Denpasar with variables of atopic history in the family, furry pets, and exposure to cigarette smoke can be seen in table 2. The analysis was performed using the chi-square method by cross tabulating to find the

relationship between the independent variable and the dependent variable. To assess the effect, the Prevalence Ratio (PR) was calculated. The data in the table showed that family history of atopy and exposure to cigarette smoke had a p value of <0.25, so multivariate analysis was performed.

**Table 2.** Bivariate Analysis Factors associated with the incidence of RA in children

Variabel	Rinitis Alergi		P Value	PR (CI 95%)
	Yes Na = 170	No Na = 66		
Gender n, (%)				
Male	75 (71%)	30 (29%)	0.853	0.985 (0.839 - 1.156)
Female	95 (72.5%)	36 (27.5%)		
Family history of atopic disease n, (%)				
Yes	71 (85.6%)	12 (14.4%)	0.001	1.322 (1.142 - 1.531)
No	99 (64.8%)	54 (35.2%)		
Furry pet n, (%)				
Yes	112 (73.2%)	41 (26.8%)	0.587	1.048 (0.883 - 1.243)
No	25 (30.1%)	58 (69.9%)		
Cigarette smoke exposure n, (%)				
Yes	85 (82.6%)	18 (17.4%)	0.002	1.291 (1.105 - 1.509)
No	85 (64%)	48 (36%)		

Multivariate analysis of factors associated with the incidence of AR in children in Denpasar with variables of atopic history in the family and exposure to cigarette smoke is presented in Table 3. The analysis was performed with multiple logistic regression test. The data in the table showed that family atopic history

remained a significant influence on the incidence of RA after confounding variables were controlled ( $\alpha$ OR 3.214; IK 95% = 1.585-6.518; P = 0.001). A history of cigarette smoke exposure is a risk factor associated with the incidence of AR in children ( $\alpha$ OR 2.655; 95% CI = 1.409-5.002; P = 0.003).

**Table 3.** Multivariate Analysis of Risk Factors with the incidence of RA in children aged 13-14 years in Denpasar

Variable	$\alpha$ OR	CI 95%		P Value
		Lower	Upper	
Family atopic history	3.214	1.585	6.518	0.001
cigarette smoke exposure	2.655	1.409	5.002	0.003

## DISCUSSION

### Characteristics of Research Subjects

This study obtained the prevalence of AR incidence in children aged 13-14 years in Denpasar as much as 72%, namely 170 out of a sample size of 236 children aged 13-14 years. The incidence of AR by the gender in this study was obtained more in the female sex, namely 72.5% of the population of children of the female sex. The male gender was found to be 71% of the population of male children. Family atopic history in children with AR incidence was found to be 85.6%. The results of this study found a history of keeping furry pets in children with AR incidence was 73.2%. A history of exposure to cigarette smoke was found in 82.6% of children who experienced AR.

### Factors Associated with the Incidence of RA in Children

The results of this study state that gender factors do not have a significant relationship with the incidence of AR in children aged 13-14 years in Denpasar city. This finding is in line with research conducted by Pinart in 2013 which found that AR is more common in women than men, with a higher percentage of female sufferers than men.<sup>11</sup> The number of AR cases in the female sex may be due to estrogen factors. Especially in patients who have experienced menstruation, during the menstrual cycle there is an increase in skin reactivity to histamine or allergen puncture, regardless of the woman's atopic status. However, in this study the relationship between gender and the incidence of AR was found to be statistically insignificant ( $p = 0.98$ ). In previous studies, it was mentioned that gender may influence IgE levels. Research by Ahmed in 2022 found that there was a tendency for men to have higher IgE levels than women in the AR group, but the difference was not very significant, and IgE levels may not be influenced by gender.<sup>12</sup> Another study mentioned that in AR before puberty, the prevalence of boys exceeded girls, but the trend reversed after puberty. It is suspected that this difference is due to the apparent impact of the hormone estrogen on disease progression.<sup>12</sup>

The results of this study found a significant relationship between family history of atopy and the incidence of AR in children in Denpasar city. Based on the results of the chi-square test, it can be said that having a family history of atopy has a higher risk than having no family history of atopy. This finding is in line with the results of research conducted by Ravn in 2022 which from the results of his meta-analysis stated that the history of atopic disease in parents is significantly related to their

offspring, with the relative effect size being similar in both parents.<sup>13</sup> Based on a journal written by Tohidinik in 2019, it is said that there is a link between allergic rhinitis and atopic history supported by a meta-analysis study which concluded that allergic rhinitis is closely related to the presence of a history of atopic diseases such as allergic rhinitis and asthma.<sup>14,15</sup> In a study by Wardani in 2020 also obtained a significant value in the statistical test of the relationship between history of asthma and allergic rhinitis where he got a significance value of 0.019 ( $p < 0.05$ ).<sup>16</sup> Based on the results of the data and its alignment with several previous studies, it can be interpreted that there is a relationship between atopic history and allergic rhinitis. The existence of a history of atopy will inherit a tendency for the immune response of Th2 lymphocytes with the formation of IgE mast cells.<sup>17</sup> Individuals who have a history of atopy in both parents will have a greater risk of developing RA than if the atopic history is only present in one of the parents.<sup>18</sup> However, it should be noted that AR is caused multifactorially. A person without a family history of atopy can also suffer from AR.

The results of this study did not find a significant relationship between keeping furry pets and the incidence of AR in children in Denpasar city. Based on the chi-square test, the relationship between the incidence of AR and keeping furry animals in this study was not statistically significantly correlated ( $p$  value = 0.587). The results of this study are not in line with research conducted by Kholid in 2020 which found that keeping dogs or cats has an association with the incidence of AR ( $p < 0.05$ ).<sup>4</sup> If you look at previous research, pets are considered to be a risk factor associated with AR, possibly because pet hair can be easily inhaled through airborne due to small particles, so it can sensitize individuals with hypersensitivity.<sup>19</sup> This study obtained different results, because there may not be hypersensitivity to pet hair. Researchers cannot confirm this because they did not conduct specific IgE tests on subjects. The results of this study indicate a significant relationship between exposure to cigarette smoke and the incidence of AR in children aged 13-14 years in Denpasar city. From this study obtained PR = 0.7, this means that children with AR who are not exposed to cigarette smoke have a prevalence rate that is 0.7 times lower than children who suffer from AR and are exposed to cigarette smoke. After the chi-square test, the relationship between the incidence of AR and exposure to cigarette smoke in this study was statistically significantly correlated ( $p$  value = 0.01). This is in line with research by Nurhaliza in 2020, which states that exposure to cigarette smoke is associated with an increased risk of allergic rhinitis. Cigarette smoke can increase oxidative stress and mucosal inflammation resulting in the production of pro-inflammatory cytokines (IL-6,

IL-8 and TNF- $\alpha$ ). This is thought to result in increased vascular permeability, impaired mucociliary clearance and excessive mucous secretion, while the indirect effect can affect the inflammatory response mediated by IgE.<sup>18</sup>

#### Family atopic history as a factor associated with the incidence of RA in children in Denpasar

This study analyzed that the presence of atopic history in the family had a risk of 3.2 times more AR incidence in children aged 13-14 years in Denpasar city ( $\alpha$ OR 3.214; IK 95% = 1.585-6.518;  $p = 0.001$ ). The results of this study are in line with previous research conducted by Ludfi in Semarang which states that atopic history in parents such as asthma, or allergies shows a significant relationship to the possibility of AR reactions, with the results of the study mentioning children with atopic history in parents are at risk 4.8 times ( $\alpha$ OR 4.833; IK 95% = 2,594-9,006;  $p = 0.001$ ) greater to experience AR.<sup>20</sup>

#### Cigarette smoke exposure as a factor associated with the incidence of RA in children in Denpasar

This study found that cigarette smoke exposure was significantly associated with the incidence of AR in children aged 13-14 years in Denpasar city ( $\alpha$ OR 2.665; IK 95% = 1.409-5.002;  $p = 0.003$ ). The results of this study are in line with previous research by Polosa in Italy in 2016 which concluded that there is a significant relationship between cigarette smoke exposure and allergic rhinitis ( $\alpha$ OR 2.98; IK 95% = 1.81-4.92;  $p < 0.0001$ ).<sup>21</sup>

The results of this study obtained factors that were significantly associated with the incidence of AR in Denpasar, namely genetic factors, namely the presence of atopic history in parents and factors from the environment, namely cigarette smoke. This study provides information that the right first step to explore AR is to know the factors associated with the incidence of AR. With this study, several risk factors that have been studied can be taken into consideration in providing education and information to pediatric patients with AR.

#### CONCLUSION AND SUGGESTIONS

Based on the research that has been carried out at SMP Tunas Daud and SMPN 10 Denpasar, it can be concluded that:

1. There is a relationship between family history of atopy and the incidence of allergic rhinitis in children aged 13-14 years in Denpasar.
2. There is no relationship between gender and the incidence of allergic rhinitis in children aged 13-14 years in Denpasar.
3. There is no association between furry pets and the incidence of allergic rhinitis in children aged 13-14 years in Denpasar.
4. There is an association between cigarette smoke exposure and the incidence of allergic rhinitis in children aged 13-14 years in Denpasar.

As for some suggestions, future research can be in the form of prospective cohort research and specific atopy IgE examination so that it can analyze other risk factors that can affect the incidence of AR disease in children in Denpasar that have not been studied in this study.

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