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## Respiratory allergy with concentration ability in young adults

### Alergia respiratoria con capacidad de concentración en adultos jóvenes

Handayani<sup>1\*</sup>, Evi Sylvia Awwalia<sup>2\*</sup>

#### SUMMARY

**Introduction:** Respiratory allergies prevalence in Indonesia, Asia, and the world ranges from 4-10 %. Patients with respiratory allergies and other chronic respiratory diseases often experienced deterioration of productivity and concentration ability. This study aims to observe the correlation between respiratory allergy and concentration ability in adults.

**Methods:** The design of the study was retrospective observational. 18-25 years old participants with or without a respiratory allergy were included. The Respiratory Allergy Prediction Test (RAPt) questionnaire was used to collect respiratory allergy data. At the same time, the Krawietz Concentration Scale questionnaire was used to measure concentration ability.

**Results:** There were 149 subjects in this study, with the female proportion was 101 (67.79 %), and the male was 48 (32.21 %). The mean age of the subjects was  $19.30 \pm 0.96$  years. The result of this study indicated that there was no significant correlation between respiratory allergy (RAPt  $\geq 1$ ) with reading and listening focus (RLF) and ( $p= 0.231$ ), control of focus before sleep (CFBS) ( $p= 0.544$ ), RLF-CFBS ( $p= 0.524$ ), and concentration ability ( $p= 0.538$ ). However, there was a tendency between respiratory allergy (RAPt  $\geq 1$ ) and uncontrolled focus ( $p= 0.070$ ; CI 90 %; power 55.60 %), and there was also a significant correlation between respiratory allergy (RAPt  $\geq 3$ ) and concentration ability ( $p= 0.029$ ; CI 95 %; power 59.84 %).

**Conclusion:** Respiratory allergy patients can perform types of work that require high concentrations only if their RAPt result is less than 3.

**Keywords:** Respiratory allergy, concentration ability, Krawietz concentration scale questionnaire, respiratory allergy prediction test questionnaire.

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#### RESUMEN

**Introducción:** La prevalencia de alergias respiratorias en Indonesia, Asia y el mundo varía entre el 4 % y el 10 %. Los pacientes con alergias y otras enfermedades respiratorias crónicas a menudo experimentaron un deterioro de la productividad y la capacidad de concentración. Este estudio tiene como objetivo observar la correlación entre la alergia respiratoria y la capacidad de concentración en adultos.

**Métodos:** El diseño del estudio fue observacional retrospectivo. Se incluyeron participantes de 18 a 25 años con o sin alergia respiratoria. Se utilizó el

cuestionario de la Prueba de predicción de alergias respiratorias (RAPt) para recopilar datos sobre alergias respiratorias. Al mismo tiempo, se utilizó el cuestionario Krawietz concentration scale para medir la capacidad de concentración.

**Resultados:** Hubo 149 sujetos en este estudio, la proporción de mujeres fue de 101 (67,79 %) y la de hombres fue de 48 (32,21 %). La edad media de los sujetos fue de  $19,30 \pm 0,96$  años. El resultado de este estudio indicó que no había una correlación significativa entre la alergia respiratoria ( $RAPt \geq 1$ ) con el enfoque de lectura y escucha (RLF) dan ( $p=0,231$ ), control de enfoque antes del sueño (CFBS) ( $p=0,544$ ), RLF -CFBS ( $p=0,524$ ) y capacidad de concentración ( $p=0,538$ ). Sin embargo, hubo una tendencia entre la alergia respiratoria ( $RAPt \geq 1$ ) y el enfoque descontrolado ( $p=0,070$ ; IC 90 %; potencia 55,60 %), y también hubo una correlación significativa entre la alergia respiratoria ( $RAPt \geq 3$ ) y la capacidad de concentración ( $p=0,029$ ; IC 95 %; potencia 59,84 %).

**Conclusión:** Los pacientes con alergia respiratoria pueden realizar tipos de trabajo que requieren altas concentraciones solo si su resultado de RAPt es inferior a 3.

**Palabras clave:** Alergia respiratoria, capacidad de concentración, cuestionario de la escala de concentración de Krawietz, cuestionario de la prueba de predicción de alergia respiratoria

## INTRODUCTION

Respiratory allergies are allergies in the airways that include allergic rhinitis and bronchial asthma (1). The prevalence of respiratory allergy cases in Indonesia, Asia, and the world ranges from 4 %-10 % (2-4). The diagnosis of respiratory allergy is confirmed by skin prick test (SPT) and provocation tests with certain allergenic substances and examination of IgE levels and other molecular tests (1).

Allergic rhinitis (AR) is an inflammatory disease of nasal mucosa caused by immunoglobulin E (IgE), especially after exposure to allergens. RA affects 10 to 20 % of the total population, and this number is increasing steadily. The severity of allergic rhinitis can be measured subjectively by calculating the total nasal symptom score (TNSS) and objectively by calculating serum IgE levels. Moderate to severe AR can affect the quality of life of patients and is found in 67.5 % of all AR patients (5). The main symptoms of AR are

sneezing, stuffy nose, itchy nose. Symptoms in eyes, ears, and throat postnasal drip are also seen in some cases (6).

While rhinosinusitis is inflammation of nasal mucosa and paranasal sinuses, one of the predisposing factors for rhinosinusitis is allergic rhinitis, and both of them have a multifactorial relationship. The incidence of acute rhinosinusitis in adults is 2-5 times a year and 7-10 times a year in children (7).

Allergic conditions, allergic asthma, and airway hyperreactivity (AHR) are known as risk factors for chronic obstructive pulmonary disease (COPD) (8). COPD is a non-communicable disease that remains become a health problem in Indonesia. The morbidity and mortality rates of COPD patients are associated with periodic exacerbations and decreased lung function. Other problems that are commonly seen in COPD patients are depression, isolation, and weight loss (9).

Patients with respiratory allergies such as allergic rhinitis, bronchial asthma, and other chronic respiratory diseases such as COPD and rhinosinusitis often experienced a deterioration in work productivity, for about  $35.8 \pm 27.56$  % (4). A study shows that people with respiratory allergies in Asia Pacific experience decreased work productivity by up to 36 %. Decreased concentration can result in decreased work ability visually and auditory (10). Another study has shown that work concentration decreases in patients with allergic rhinitis after a nasal provocation test is performed (11). Patients with respiratory allergies in the Asia Pacific also have a low quality of life. Most asthma patients have a Mini Asthma Quality-of-Life Questionnaire (miniAQLQ) score of  $4.8 \pm 1.20$  (range 1-7) (4). In addition, allergic conditions tend to increase concentration disorders such as attention-deficit hyperactivity disorder (ADHD) in children (12). ADHD is a common neurobiological disorder in primary school-age children. The main symptoms of ADHD are hyperactivity, inattention, and impulsivity. If left untreated, ADHD children will have social, educational, or work problems in their community due to the severity of the symptoms (13).

Nasal congestion symptoms in allergic conditions will negatively impact the overall

quality of life, including the patient's physical and emotional condition. Generally, people with an allergy will experience reduced productivity, difficulty concentrating, decreased time and quality of rest, fatigue, and can be stress triggering factors (14). In addition, respiratory allergies increase cholinergic response and decrease the beta-adrenergic response, thereby decreasing the activity of the reticular activating system (RAS) (12,15). A decrease in RAS activity is accompanied by declining in reaction timeliness and a further decrease in concentration ability, primarily through its association with reading and listening focus (RLF) and control of focus before sleep (CFBS) (16).

Concentration ability based on Krawietz Concentration Scale (KCS) is found to be positively correlated with the Mindfulness Questionnaire (MQ), Boredom Proneness Scale (BPS), and The Adult Behavior Checklist (ABC) (17). Mindfulness training on sensory stimulation such as breath movements can reduce bronchial asthma symptoms subjectively and positively correlate with the ability to concentrate (17,18). The BPS value is positively correlated with somatization in the Hopkins Symptom Checklist (HSCL), which included complaints of difficulty breathing (19,20).

To date, not many studies have analyzed the relationship between the overall history of respiratory allergies and concentration ability in young adults. This study aims to prove the relationship between respiratory allergy and concentration ability in young adults.

## METHODS

### Design

The research design is a retrospective study with a cross-sectional observational type. The research was conducted at the Faculty of Medicine, Universitas Nahdlatul Ulama Surabaya, Surabaya, Indonesia.

### Sample

The population of this study was young adults. The population must meet the inclusion

and exclusion criteria. The inclusion criteria included all students aged 18-25 years with or without respiratory allergies. In comparison, the exclusion criteria included a history of smoking in the last two years, a history of lung disease and intra-abdominal masses based on the doctor's verdict, and an average sleep duration of fewer than 5 hours in the past month.

Sampling was done by the total sampling technique and cluster random sampling. The sample size that must be met to identify the prevalence of respiratory allergy was 133 people who met the minimum requirements ( $n_1=100$ ). The sample size to analyze the relationship between respiratory allergy and some/all components of concentration ability was 16 people per group (including sleep duration criteria), which also met the minimum requirements ( $n_2=15$ ).

### Measurement

Respiratory allergies were assessed based on the subject's history which met the criteria for measuring respiratory allergies during the past year. Criteria  $\geq 3$  of 9 were for prevalence, and criteria  $\geq 1$  of 9 were for different tests. The Respiratory Allergy Prediction test (RAPt) questionnaire was used to collect respiratory allergy data. The results obtained were subjects with positive RAPt and negative RAPt. Meanwhile, concentration ability is an assessment of a subject's concentration based on measuring instruments which include control of focus (CF), uncontrolled focus (UF), RLF, and/or CFBS. The KCS questionnaire was used to collect concentration ability data with a score of 49-343. The RLF component shows a person's ability to maintain attention in visual (reading) and auditory (listening) stimuli. The CFBS component showed a person's ability to ignore all internal and external stimuli to fall asleep. The CF and UF components are non-specific in showing the ability to maintaining attention to stimuli and control motor (writing) and verbal (speaking) responses. Thus, RLF and CFBS were components of concentration ability that were more relevant to the inner-outer psychoneurological process.



**Data Collection**

Data collection was carried out on a primary basis. Subjects with RAPt measurement results that met at least 3 of the 9 criteria were included in the RAPt (+) group, while KCS was presented in the form of scores with a range of 49-343. The characteristics of the subjects observed were age, gender, the proportion of respiratory allergies with criteria RAPt  $\geq 3$  and RAPt  $\geq 1$ , and KCS and its components. The data were displayed in the form of mean and standard deviation (SD).

**Data Analysis**

Univariate analysis was performed using the data normality test (Kolmogorov-Smirnov) on KCS score. The score was presented in mean forms and 95 % confidence interval (CI) if normally distributed. Other alternatives were presented in terms of median and minimum-maximum values. All data were presented in

tabular form. Bivariate analysis was performed by unpaired t-test on mean KCS score if normally distributed. Another alternative will be tested with the Mann-Whitney test. The value of  $\alpha = 0.05$  was used as a limit in determining the accepted hypothesis. Data analysis was carried out using free licensed software, namely the Statistical Analysis System (SAS) University Edition.

**RESULTS**

In total, 149 study subjects met the inclusion and exclusion criteria, as shown in Table 1. The average age of the study subjects was  $19.30 \pm 0.96$  years, with the highest proportion of sex being female, which was 67.79 %. The proportion of respiratory allergies with RAPt 3 criteria was 4.70 %, while those with RAPt 1 were 42.95 %. The KCS value of the research subjects was  $194 \pm 14$  with a CF value of  $64 \pm 11$ , UF  $67 \pm 12$ , RLF  $39 \pm 5$ , CFBS  $23 \pm 4$ , and RLF-CFBS  $62 \pm 7$ .

Table 1.  
Characteristics of research subjects

Characteristics (n=149)	Mean $\pm$ SD or Proportion
Age (years)	$19.30 \pm 0.96$
Sex	
Male	48 (32.21 %)
Female	101 (67.79 %)
Respiratory allergy with RAPt > 3	
RAPt3+	7 (4.70 %)
RAPt3-	142 (95.30 %)
Respiratory allergy with RAPt $\geq 1$	
RAPt1+	64 (42.95 %)
RAPt1-	85 (57.05 %)
Krawietz Concentration Scale (KCS)	$194 \pm 14$
Control of Focus (CF)	$64 \pm 11$
Uncontrolled Focus (UF)	$67 \pm 12$
Reading and Listening Focus (RLF)	$39 \pm 5$
CF Before Sleep (CFBS)	$23 \pm 4$
RLF-CFBS	$62 \pm 7$

RAPt: Respiratory Allergy Prediction test

The prevalence of respiratory allergy in young adults in 2017 was 4.7 % (n= 149). Results of analysis showed that there was no relationship between respiratory allergy and RLF (p=0.231),

CFBS (p= 0.544), and the combination of RLF-CFBS (p= 0.524). Overall, there was no association between respiratory allergy (RAPt > 1) and KCS (p= 0.538). In addition, there was a

significant tendency association ( $p=0.070$ ) with a 90 % confidence level between respiratory allergy and UF. In contrast, the analysis results showed an association between respiratory allergy (RAPt  $\geq 3$ ) and KCS ( $p=0.029$ ).

## DISCUSSION

The results showed no association between respiratory allergy (RAPt 1) with RLF, CFBS, RLF-CFBS combination, and concentration ability. However, there was an association between respiratory allergy (RAPt  $\geq 1$ ) and UF, and there was an association between respiratory allergy (RAPt  $\geq 3$ ) and concentration ability. Respiratory allergies tend to decrease concentration ability through mechanisms that do not involve a decrease in sleep quality or reaction time. Decreasing concentration ability in patients is caused by an increased cholinergic response to acetylcholine and decreased beta-adrenergic response to norepinephrine (12). This condition decreases the activity of the reticular-activating system (RAS) in the brain (15), which is associated with decreasing concentration ability through other mechanisms that do not involve sleep quality and reaction time. However, this needs to be investigated further.

Decreased concentration ability is also significantly associated with a respiratory allergy when using the RAPt  $\geq 3$  criteria. Decreased concentration ability can elevate respiratory allergy manifestation through the HPA axis pathway (18). This HPA axis correlation is caused by a decrease in mindfulness, which is directly lower concentration ability proportionally (17). However, this needs to be proven in research that using mindfulness indicators.

Previous studies have shown the role of RAS in concentration ability, which is a relationship between reaction time and concentration ability, especially in RLF and CFBS components. CFBS's role is also supported by a negative correlation between sleep patterns (Pittsburgh Sleep Quality Index) and reaction time. Respiratory allergies are related to concentration ability through RAS activity, especially in maintaining an awake state and sleep. Studies show CBFS components are directly related to sleep patterns (16). CBFS

affects sleep quality deterioration in terms of the ability to initiate sleep so that RAS activity is decreased.

The opposite correlation between concentration ability and respiratory allergy appears as a correlation of KCS (concentration ability) with MQ (mindfulness) along with BPS and ABC (17). Increased mindfulness can reduce the frequency of asthma symptoms by decreasing the stress response and increasing the hypothalamus-pituitary-adrenal (HPA) axis to secrete cortisol (18).

Respiratory allergy assessment such as skin prick test (SPT), in vitro IgE examination, allergen provocation, and other molecular tests are needed to determine whether referral for further allergy testing is necessary. This examination requires a high cost and is not generally available so that an inexpensive examination can be developed that can be carried out by general practitioners. The RAPt questionnaire is considered adequate because it is easy to use in clinical practice and has a relatively affordable price. This questionnaire contains nine questions related to respiratory allergies, which include both allergic rhinitis and asthma (1).

The ability to concentrate as a cognitive process refers to attention. There are three correlation variations between concentration ability and focused attention: 1) concentration as part of the attention process; 2) concentration as a distinct process of attention; or 3) concentration as a combination of two or more types of attention. Some researchers use the first variation, which considers concentration level as one of several types of attention, namely focused attention, sustained attention, controlled attention, and vigilance. Thus concentration ability is the ability to maintain attention and reduce distraction beyond self-control despite thought stimuli or internal or external stimuli. The distraction itself must not lose awareness of the previous object of attention (17).

A decrease in only concentration ability cannot be considered as a disorder or disease because there were variations in a person's concentration ability, especially in school-age children. There are three main methods for assessing concentration ability: performance-based concentration checks, structured interviews,

and self-assessment scales. Among the three, the self-assessment scale is the most practical examination method and can be used to measure the degree of concentration ability in subclinical conditions quantitatively (21)

The method of examining concentration ability with the Krawietz Concentration Scale is a method with a self-assessment scale. This method was developed because the previous methods were too specific for particular needs, such as concentrating on sports. The test of Attentional and Interpersonal Style (TAIS) concentration ability assessment method is considered unable to measure all components of concentration ability and has low reliability. This concentration scale has shown good reliability, with a Cronbach alpha value of 0.93 (17).

### CONCLUSION

The results of this study showed a significant relationship between respiratory allergy (RAPt  $\geq 3$ ) and the ability to concentrate, although there was no significant relationship between respiratory allergy (RAPt  $\geq 1$ ) with UF, RLF, CFBS, RLF-CFBS combination, and concentration ability. Patients with respiratory allergies should pay attention to the RAPt score in choosing the type of work.

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