Medica Hospitalia
Journal of Clinical Medicine
Med Hosp 2024; vol 11 (2) : 177–182

OPEN ACCESS

Original Article

The Effect of Cold Temperature on the Severity of Allergic Rhinitis Based on Visual Analog Scale (VAS) Score among Medical Students of Malikussaleh University

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p-ISSN: 2301-4369 e-ISSN: 2685-7898
https://doi.org/10.36408/mhjcm.v11i2.1087

Accepted: February 16th, 2024
Approved: June 20th, 2024

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Abstract

Background : Allergic rhinitis is a common condition caused by inflammation of the nasal mucosa after exposure to allergens and is mediated by Immunoglobulin E (IgE). Cold temperatures can aggravate the symptoms of allergic rhinitis. Allergic rhinitis is not fatal, but it can cause a decrease in the patient's quality of life if the symptoms are severe. The severity of allergic rhinitis symptoms is difficult to measure as it should match patient's perception, so VAS is a quantitative measurement tool used. Although VAS is a simple and easy-to-use tool, its use as self-monitoring for AR patients is still infrequent to minimize symptom exacerbations and maintain control of allergic rhinitis. This study aims to examine the effect of cold temperature on the severity of allergic rhinitis based on VAS score.

Methods : This research is an experimental with a one-group pretest-posttest study. The study samples involved 75 students suffering from allergic rhinitis assessed with the Score for Allergic Rhinitis (SFAR) questionnaire assessment from the class of 2020, 2021, and 2022. Subjects' pain level was measured before and after the intervention. The intervention was in the form of cold temperature exposure for 15 minutes in a room with a temperature of 18°. Data were analyzed using the Wilcoxon test.

Results : The results showed that the mean VAS score before the intervention was 0 while after the intervention was 38.61 ± 24.07. This shows that the mean VAS score after the intervention is higher than the mean VAS score before the intervention (*p-value* = 0.00 <0.05).

Conclusion : The results of this study indicate that the effect of cold temperature can increase the severity of allergic rhinitis.

Keywords : allergic rhinitis, SFAR, cold temperature, VAS

INTRODUCTION

Allergic rhinitis is an inflammatory condition of the nasal mucosal lining caused by an Immunoglobulin E (IgE)-mediated allergic reaction to an allergen. Symptoms include sneezing, rhinorrhea, itchy nose, and nasal congestion. These symptoms can spread to other organs, such as the eyes, skin, and lungs. Allergic rhinitis can be classified based on the duration of symptoms (intermittent and persistent) and severity (mild, asymptomatic, and moderate-severe). Intermittent is symptoms that occur ≤4 days per week or last ≤4 weeks. While persistent symptoms that appear >4 days per week and last >4 weeks. Allergic rhinitis symptoms can interfere with daily activities and have an impact on socioeconomic aspects.[1]

The prevalence of allergic rhinitis (AR) in the world ranges from 10–20%, while in Indonesia it ranges from 1.5–12.4%. This figure is quite high, although AR does not cause death, it can affect a person's quality of life. Aceh province has the highest prevalence of 49.8% and North Sumatra province has the lowest prevalence of 5.9%. However, for Lhokseumawe City there is no data on the prevalence of RA. The prevalence of allergic rhinitis in the last 10 years has increased worldwide, including Indonesia. Genetic and environmental factors are the cause. The prevalence of allergic rhinitis also varies from country to country, influenced by geographical factors and potential aeroallergens. Several other factors such as air temperature, occupation, environment, exposure to cigarette smoke, and previous history of allergy, can aggravate symptoms.[2]

Cold air can be a triggering factor for allergic rhinitis.[3] In cold temperatures, exposure to allergens increases due to elevated dust and contaminant levels, poor ventilation, changing temperatures, and dry air. This can lead to irritation and hypersensitivity of the nasal mucosa, increasing the risk of allergies.[4] Cold temperatures can cause functional impairment in individuals with respiratory diseases. This is because cold temperatures can cause hyperresponsiveness and constriction of the respiratory airways. In addition, cold temperatures can also worsen complaints in individuals who have chronic respiratory diseases.[5] Air conditioners (ACs) cool, dry, clean, and circulate the air. However, air conditioners that are too cold and dry can trigger symptoms of allergic rhinitis, such as runny nose, sneezing, and nasal congestion.[6] Research conducted by Yogeetha R., *et al* in 2007 which examined the "Effects of temperature changes on nasal patency" showed that when exposed to air conditioning temperatures with a temperature of 18° for 15 minutes the nose tends to experience increased nasal resistance compared to normal room temperature air.[7]

The symptoms of allergic rhinitis are subjective and should match the perception of the patient. Signs and symptoms of AR can vary from individual to individual. Therefore, it is very difficult to measure the severity of allergic rhinitis. Visual Analog Scale (VAS) is a quantitative measurement tool used to assess the severity of AR symptoms. Several studies have shown that VAS can be used to assess AR symptoms and assess the quality of life of patients. Visual Analog Scale (VAS) is a simple and easy-to-use tool that is effective for measuring disease severity and objectifying symptoms and can monitor the development of allergic rhinitis in patients. VAS can also be used to evaluate the level of disease control. The VAS consists of a 100 mm horizontal line, with the left end representing no symptoms and the right end representing the most severe symptoms. Higher VAS scores indicate greater intensity of the symptoms they feel. Although its application is simple and effective in assessing AR symptoms, its use as self-monitoring is still very rare using VAS to minimize symptom exacerbation and maintain allergic rhinitis control.[8]

Therefore, researchers are interested in conducting further research to examine the effect of cold temperature on the severity of allergic rhinitis using VAS assessment in students of the Malikussaleh University Medical Study Program.

METHODS

This study is an experimental study with a one-group pretest-posttest. The study was conducted at the Faculty of Medicine, Malikussaleh University, Lhokseumawe, Indonesia, on August 27 – September 18, 2023. This research was conducted for 23 days. The study population was students of the Malikussaleh University Medical Study Program class of 2020, 2021, and 2022. The sample was selected using a total purposive sampling technique, namely respondents who met the inclusion and exclusion criteria. The inclusion criteria of this study were students of the Malikussaleh University Medical Study Program class of 2020, 2021, and 2022, students who suffered from allergic rhinitis based on the results of initial screening using the Score For Allergic Rhinitis (SFAR) questionnaire, willing to become research subjects by filling out informed consent and questionnaires completely, and not using drugs for at least 7 days that could affect the results of the study during the study period (antihistamines, corticosteroids, decongestants, and herbal medicines). Meanwhile, the exclusion criteria in this study were students who had a history of asthma. After using the total purposive sampling technique, the total number of respondents was 75 people. The independent variable of this study was cold temperature. The dependent variable was the severity of allergic rhinitis. Cold temperature was measured using a Samsung brand 1 PK air conditioner and calibrated with a Notale brand room thermometer with model number NTL-HM370. The temperature was

set at 18° in a 3 x 4 room. All research samples were divided into 19 sessions. In 1 session, 4 research samples were given cold temperature intervention for 15 minutes in the room. The severity of allergic rhinitis was measured using a Visual Analog Scale (VAS) score that has a horizontal line of 100 mm. The higher the score given on the VAS sheet, the more severe the AR symptoms experienced by the sufferer. Scores <20 mm are categorized as well-controlled AR, scores of 20 – 50 mm are categorized as partially controlled AR, and scores >50 mm are categorized as uncontrolled AR. Before and after the cold temperature intervention, the research sample was given a VAS sheet to assess the severity of AR symptoms they felt and what symptoms had worsened after the cold temperature intervention. Data processing and analysis were carried out using the Wilcoxon test with a significance value set at p <0.05. Wilcoxon test was used to see the effect of cold temperature on the severity of allergic rhinitis based on VAS score. The Research was approved by Health Research Ethics Committe of Faculty of Medicine Malikussaleh University Lhokseumawe.

RESULTS

Based on the screening results, 75 people met the criteria for allergic rhinitis with SFAR ≥7. Of these, 53 samples (70.7%) were female and 22 samples (29.3%) were male. This proportion was obtained by total purposive sampling technique, which is a sampling technique with certain considerations and all samples that meet the inclusion and exclusion criteria.

The results of this study showed that some AR symptoms in the study sample worsened after cold temperature intervention (Table 1). Whereas before the cold temperature intervention, all research samples did not experience worsening AR symptoms.

Based on the table above, it can be concluded that several symptoms of AR can appear simultaneously in samples after cold temperature intervention. The most common symptoms of allergic rhinitis complained by the study samples were sneezing as many as 42 samples, rhinorrhea as many as 34 samples, itchy nose as many as 22 samples, watery eyes as many as 17 samples, nasal congestion as many as 10 samples, asymptomatic as many as 8 samples, itchy eyes as many as 4 samples, and reddish eyes as many as 3 samples. The well-controlled allergic rhinitis category includes 3 symptoms listed in the table, including rhinorrhea, sneezing, and nasal congestion. The partially controlled AR category includes 5 symptoms listed in the table, including sneezing, rhinorrhea, itchy nose, nasal congestion, and watery eyes. While in the uncontrolled AR category, symptoms such as sneezing, rhinorrhea, itchy nose, nasal congestion, watery eyes, itchy eyes, and eye redness can all occur.

Based on the VAS score assessment carried out by the research sample, the level of control of allergic rhinitis can be classified both before the intervention (pretest) and after the cold temperature intervention (posttest). The results of the study before the cold temperature intervention, all VAS score sheets filled out by the research samples showed a score of 0, so all research samples were classified into the category of well-controlled AR. While the level of AR control varies after cold temperature intervenes (Table 2).

Based on the Table 2, it can be concluded that before the cold temperature intervention, all research samples (100%) had a mean ± SD of 0 based on the VAS score. This is because all samples have a value of 0 on their VAS score. The research sample also did not show any worsening of AR symptoms. Meanwhile, after the cold temperature intervention at 18° for 15 minutes, most of the research samples showed an increase in VAS scores. There is a difference in individual values, with mean ± SD of 38.61 ± 24.07. This indicates that there is an exacerbation of allergic rhinitis symptoms experienced by the research sample, as evidenced by an increase in the

TABLE 1
Worsening of AR Symptoms in Research Samples After Cold Temperature Intervention

Symptoms AR	Control Level of Allergic Rhinitis (AR)		
	Well controlled	Partially controlled	Not controlled
Asymptomatic	8	–	–
Sneezing	2	21	19
Rhinorrhea	3	20	11
Itchy nose	–	14	8
Nasal congestion	1	2	7
Watery eyes	–	4	13
Itchy eyes	–	–	4
Eye redness	–	–	3

TABLE 2
AR Control Level After Cold Temperature Intervention (n=75)

Control Level of Allergic Rhinitis		
Well controlled (<20 mm)	**Partially controlled (20 – 50 mm)**	**Not controlled (>50 mm)**
15	37	23

TABLE 3
Analysis of Differences in VAS Scores Before (Pretest) and After Cold Temperature Intervention (Posttest)

Group	Median	Min	Max	X ± SD	*p-value*
Pretest	0	0	0	0	0.000
Posttest	33	0	80	38.61 ± 24.07	

mean VAS score before and after the cold temperature intervention.

The results of the analysis using the Wilcoxon test also showed that there was a significant difference between the pretest and posttest results on the VAS score of Malikussaleh University Medical Study Program students. This is known from the *p-value* = 0.000 <0.05. Thus, the research hypothesis (Ha) is accepted in this study and it can be concluded that cold temperature affects the severity of allergic rhinitis based on Visual Analog Scale (VAS) scores in Malikussaleh University Medical Study Program students.

DISCUSSION

The results of this study suggest that cold temperature intervention can lead to an increase in the severity of allergic rhinitis. Air temperature can affect respiratory function directly or indirectly. Cold air can trigger an allergic rhinitis attack by increasing airway hyperresponsiveness which causes narrowing of the respiratory tract. This finding is in line with previous studies showing that exposure to cold temperatures can trigger allergic reactions, worsen allergic rhinitis symptoms, and increase the risk of impaired respiratory function in individuals with allergic rhinitis. The increased severity of allergic rhinitis symptoms due to cold temperatures can be caused by several factors, including increased resistance and decreased nasal patency, water loss that occurs during cold temperature exposure, as well as nasal mast cell activation, and sensory nerve stimulation that can trigger cholinergic reflexes, causing rhinorrhea.[9]

Based on the Central Board of the Indonesian Ear Nose Throat Head Neck Surgery Specialist Association in 2016, cold and dry air can be a triggering factor for allergic reactions, regardless of the type of allergen.[10] Cold air can cause blood vessels in the nasal mucosa to dilate (vasodilation), resulting in decreased airflow in the nose and increased nasal resistance. This can cause respiratory distress, especially nasal congestion.[11] In addition, allergic rhinitis symptoms can also be caused by the nervous system. An imbalance between the parasympathetic and sympathetic nervous systems can cause the blood vessels in the nose to become more permeable and the mucus glands under the nasal mucosa layer to produce more mucus. This can lead to symptoms of rhinorrhea and nasal congestion.[12] Symptoms of allergic rhinitis can also involve the eyes, with itching, watering, or redness. The pathological mechanism involves type-I hypersensitivity mediated by IgE.[13]

Besides the cold temperature factors, other factors can affect the symptoms of allergic rhinitis, one of which is gender. Based on the results of research on the prevalence of allergic rhinitis, women are higher than men. This is supported by research by Utama in 2010 and Rafi in 2015 which found that women experience more allergic rhinitis. Rambe's research in 2013 explained that this can occur because women and men have different perceptions of pain. Women may be more sensitive to pain so they seek medical attention more often. However, the prevalence of allergic rhinitis in children, boys experience allergic rhinitis more often than girls. However, after adulthood, allergic rhinitis is higher in women than men. This is due to hormones such as estrogen and progesterone which play an important role in women's tendency to develop allergic diseases. These hormones support allergic responses such as Th2 polarization, trigger degranulation of mast cells and basophils, and increase Th2 cell production.[14]

The level of allergic rhinitis control can be determined through VAS scores. VAS score >50 mm indicates uncontrolled AR, VAS 20 – 50 mm indicates partially controlled AR, and VAS < 20 mm indicates well-controlled AR.[15] The degree of control of allergic rhinitis is proportional to its severity. The more severe the allergic rhinitis, the less controlled it will be. A well-controlled allergic rhinitis is a condition where the patient does not experience symptoms or the symptoms do not interfere with daily activities. While partially controlled or uncontrolled allergic rhinitis is a condition that makes patients experience symptoms that interfere with daily activities.[16] The varying degree of control of allergic rhinitis is due to the individual's response to cold temperatures which can also vary, thus affecting whether or not symptoms appear during the intervention. In general, allergic rhinitis symptoms are caused by environmental factors, such as exposure to allergens, one of which is due to exposure to cold temperatures, and internal factors such as excessive immune response.[17] Therefore, people with allergic rhinitis need to understand the condition of the disease to recognize signs of exacerbation and take preventive measures.[18]

AR symptoms may result from a second-phase allergic reaction. Second-phase allergic reactions occur when allergens bind to IgE bound to mast cells and basophils. This causes mast cells and basophils to release chemicals, such as histamine, prostaglandins, leukotrienes, bradykinin, and Platelet Enacting Figure (PAF). These chemicals cause inflammation of the nasal mucosa, resulting in symptoms of allergic rhinitis, such as sneezing, itchy nose, nasal congestion, and rhinorrhea.[19] Late-phase reactions are inflammatory responses that occur after allergen exposure. This reaction can prolong the symptoms of allergic rhinitis and increase the risk of future exacerbation of symptoms. Cytokines and chemokines released during late-phase reactions can lead to further release of inflammatory mediators and will worsen allergic rhinitis symptoms.[20]

Normally, in people with allergic rhinitis, repeated exposure to allergens causes the immune system to produce specific IgE antibodies against those allergens. When the sensitizing allergen binds to IgE antibodies bound to cells, the cells release chemical mediators such as histamine, leukotrienes, prostaglandins, and kinins. These chemical mediators cause immediate hypersensitivity in the form of itching in the nose, eyes, and throat, sneezing, and nasal congestion.[20]

CONCLUSION

This study concludes that exposure to cold temperatures can increase the severity of allergic rhinitis symptoms based on VAS scores. Assessment using the VAS score is expected to be a self-monitoring for allergic rhinitis patients to minimize symptom exacerbation and maintain allergic rhinitis control.

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