



## Systematic Journal Review: The Effect of Age and Obesity on Chronic Rhinitis and Allergic Rhinitis

**Nabila Azzahra Permata Putri**

Fakultas Kedokteran, Universitas Muhammadiyah Surakarta, Jawa Tengah, Indonesia

Email: [nabila.azzahra.pp@gmail.com](mailto:nabila.azzahra.pp@gmail.com)

### Abstract

*Chronic rhinitis and allergic rhinitis are common inflammatory upper airway diseases with substantial clinical impact. Age and obesity are considered potential determinants influencing disease occurrence and presentation. This study aimed to systematically evaluate the effects of age and obesity on chronic rhinitis and allergic rhinitis. A Systematic Journal Review was conducted following PRISMA guidelines. Literature searches were performed in PubMed, Scopus, Web of Science, ScienceDirect, and Google Scholar from 2020 to 2025. Eligible studies were qualitatively analyzed using narrative synthesis. Ten primary studies were included in the final analysis. Older age was consistently associated with a higher prevalence of non-allergic chronic rhinitis, while allergic rhinitis predominated in children and young adults. Obesity was significantly associated with chronic rhinitis in adults. However, findings regarding obesity and allergic rhinitis in children and adolescents were inconsistent. The interaction between age and obesity influenced clinical phenotype and disease severity. Age and obesity significantly affect rhinitis occurrence with distinct patterns across age groups.*

**Keywords:** Age, Allergic Rhinitis, Chronic Rhinitis, Obesity, Systematic Review.

### INTRODUCTION

Chronic rhinitis and allergic rhinitis are inflammatory disorders of the upper respiratory tract with high prevalence across various age groups and wide-ranging clinical impacts, including reduced quality of life, decreased work and academic productivity, and increased healthcare burden (Kais et al., 2024). Age-related changes influence systemic immune responses and respiratory mucosal immunity, such as age- and season-dependent variations in immune biomarkers, which in turn alter the clinical patterns and disease severity of rhinitis (Van Woudenberg et al., 2024).

In addition, aging leads to modifications in the structure and function of the nasal mucosa as well as a decline in mucociliary clearance, which increases susceptibility to chronic inflammation and raises the likelihood of non-allergic presentations or mixed phenotypes. Consequently, disease onset and therapeutic responses may differ across age groups (Tai et al., 2024). Therefore, understanding the influence of age on the pathogenesis and clinical manifestations of rhinitis is essential for designing age-adapted diagnostic and therapeutic strategies aimed at reducing the functional impact and economic burden of this disease.

Obesity is associated with a state of low-grade chronic systemic inflammation, in which adipokines and pro-inflammatory cytokines released by adipose tissue modulate immune function and may increase susceptibility to inflammatory diseases of the

**Penulis Korespondensi:**

[Nabila Azzahra Permata Putri](mailto:nabila.azzahra.pp@gmail.com) | [nabila.azzahra.pp@gmail.com](mailto:nabila.azzahra.pp@gmail.com)

respiratory tract (Khanna et al., 2022). Although chronic rhinitis and allergic rhinitis have been extensively studied, empirical evidence regarding the simultaneous role of age and obesity as risk factors or disease modifiers has yielded heterogeneous results, including differences in effects across age groups and types of rhinitis, resulting in inconsistent findings (Nam et al., 2021; Zhou et al., 2020).

The proposed pathophysiological mechanisms involve adipokine dysregulation, a shift in macrophage phenotype toward a pro-inflammatory profile, and interactions between immunological aging processes and obesity-related inflammation, which together have the potential to alter clinical phenotypes and therapeutic responses in patients with rhinitis (Khanna et al., 2022; Voltan et al., 2024). Therefore, a systematic assessment integrating the most recent evidence is required to elucidate how age and obesity simultaneously affect the incidence, severity, and clinical characteristics of chronic rhinitis and allergic rhinitis (Tai et al., 2024).

Most previous studies have examined the effects of age or obesity separately on chronic rhinitis and allergic rhinitis, resulting in limited exploration of their simultaneous association (Yum et al., 2021). Findings regarding the relationship between obesity and allergic rhinitis remain inconsistent, as some observational studies report significant associations, whereas other population-based studies do not identify meaningful relationships (Nam et al., 2021). These discrepancies are likely attributable to heterogeneity in study design, differences in the definitions of obesity and rhinitis, and variations in the control of confounding factors such as comorbidities and environmental exposures. Consequently, studies employing standardized definitions and methodologies are required to examine the interaction between age and obesity in relation to rhinitis phenotypes (EPOS, 2020). Thus, systematic studies or primary analyses that simultaneously compare age subgroups and BMI categories are necessary to clarify causal relationships and provide an evidence base for more targeted clinical recommendations (Harugop, Walia, et al., 2020).

The absence of a structured synthesis of the literature on the effects of age and obesity on chronic rhinitis and allergic rhinitis limits the ability of researchers and policymakers to formulate evidence-based clinical recommendations, as existing primary studies are highly heterogeneous in terms of design, population characteristics, and methodological quality (Nam et al., 2021). Large-scale studies suggest a plausible association between obesity and upper airway diseases, including findings of associations with chronic rhinosinusitis and indications of increased risk for respiratory allergies; however, results remain inconsistent across populations and are often influenced by differences in sample size and the definitions of obesity and rhinitis (Morag et al., 2023). In addition, studies examining the effects of age demonstrate variations in phenotypes and therapeutic responses across different age groups, thereby complicating the generalization of findings in the absence of adequate age-stratified analyses (Voltan et al., 2024). Therefore, standardized systematic reviews and meta-analyses are required to evaluate the evidence based on study design, population characteristics, and risk-of-bias assessment in order to generate robust conclusions for health policy and clinical practice (Zhou et al., 2020).

Systematic journal review methodology has significant strengths in scientific research because it facilitates the planned, transparent, and structured collection and analysis of evidence through predefined procedures to comprehensively and reproducibly address research questions (Calderon Martinez et al., 2024). This approach enables the identification of relationship patterns, result consistency, and inter-study differences by synthesizing findings from relevant primary studies and critically appraising their methodological quality, thereby enhancing the accuracy and generalizability of evidence

synthesis (Shaheen et al., 2023). Furthermore, the application of this method with strict inclusion criteria and systematic quality assessment helps minimize bias and improve the validity of research conclusions, allowing the results to serve as a strong scientific foundation for future research development and evidence-based practice (Poklepović Peričić & Tanveer, 2019). Accordingly, systematic journal reviews provide a robust basis for formulating prevention strategies, health management approaches, and more targeted policies by presenting a comprehensive overview of the available scientific evidence.

This study aims to systematically analyze the effect of age on the incidence and characteristics of chronic rhinitis and allergic rhinitis based on empirical findings from published studies. In addition, this study examines the relationship between obesity and the risk, severity, and clinical manifestations of chronic rhinitis and allergic rhinitis in order to achieve a more comprehensive understanding of the role of metabolic factors in these conditions. This study also seeks to synthesize scientific evidence regarding the interaction between age and obesity as determinant factors that may simultaneously influence the occurrence of rhinitis. Overall, the findings are expected to provide a strong and comprehensive scientific basis for the development of future research and to strengthen evidence-based clinical approaches in the management of chronic rhinitis and allergic rhinitis.

## **METHOD**

This study employed a Systematic Literature Review (SLR) design to comprehensively identify, appraise, and synthesize scientific evidence concerning the influence of age and obesity on the occurrence of chronic rhinitis and allergic rhinitis. The SLR approach was selected due to its capacity to provide a structured, transparent, and reproducible synthesis of findings from multiple primary studies, thereby enabling a robust evaluation of demographic and metabolic determinants in upper airway inflammatory disorders. The entire review process was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological rigor, transparency, and reproducibility.

A systematic search of the literature was performed using five electronic databases: PubMed, Scopus, Web of Science, ScienceDirect, and Google Scholar. The search strategy applied combinations of relevant keywords using Boolean operators (AND, OR) to capture studies aligned with the research objectives. The search terms included: “age” OR “aging” OR “older adults”; “obesity” OR “body mass index” OR “overweight”; “chronic rhinitis” OR “non-allergic rhinitis”; “allergic rhinitis”; and “inflammation” OR “upper airway disease.” This strategy was designed to maximize sensitivity while maintaining relevance to the specific topic of rhinitis.

Eligible articles were restricted to publications from the last five years (2020–2025) to ensure that the synthesized evidence reflected current scientific developments and clinical understanding. The selection process involved two independent reviewers who screened titles and abstracts based on predefined inclusion and exclusion criteria. Studies were included if they examined the association between age and/or obesity and chronic rhinitis or allergic rhinitis, employed observational or experimental designs, and were published in peer-reviewed scientific journals. Articles that passed the initial screening underwent full-text assessment to confirm methodological eligibility and relevance. Discrepancies between reviewers were resolved through discussion, and when consensus could not be reached, a third reviewer was consulted.

Data extraction was conducted systematically using a standardized form to ensure consistency across studies. Extracted variables included: author and year of publication; country of study; study design and sample characteristics (including age distribution, sex,

and sample size); age indicators (such as age groups or mean age); obesity-related parameters (including body mass index, waist circumference, or obesity classification); type of rhinitis investigated (chronic rhinitis or allergic rhinitis); and principal findings related to the association between age, obesity, and rhinitis outcomes, including incidence, severity, or clinical manifestations.

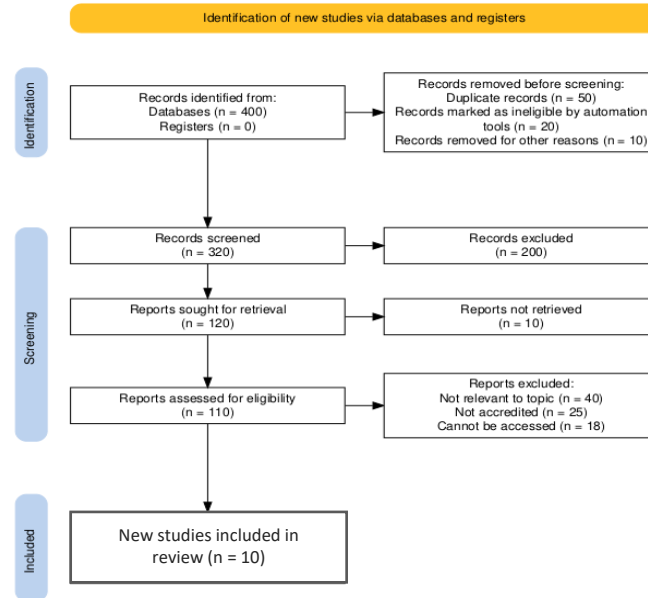


Figure 1. PRISMA Flow Diagram

The literature selection process was documented using a PRISMA flow diagram that illustrates each stage of article identification, screening, eligibility assessment, and inclusion. The diagram specifically represents the selection of studies addressing chronic rhinitis and allergic rhinitis, ensuring full consistency with the research topic. Of the total records identified through database searching, duplicates and ineligible records were removed prior to screening. Following title and abstract screening, only studies meeting the inclusion criteria advanced to full-text assessment. Ultimately, ten studies were deemed eligible and included in the final synthesis. This stepwise process enhances the transparency of the review and allows readers to clearly understand the basis for study inclusion and exclusion.

To strengthen the scientific credibility of the review, the methodological quality of the included studies was assessed using the Newcastle–Ottawa Scale (NOS), which is widely applied for evaluating the quality of non-randomized studies. The NOS assesses three key domains: selection of study groups, comparability of groups, and ascertainment of exposure or outcomes. Each study was independently evaluated by two reviewers, and scores were used to categorize study quality as low, moderate, or high. The results of this quality assessment were summarized in a dedicated table to provide readers with a clear overview of the methodological robustness of the included evidence.

Data analysis was performed qualitatively using a narrative synthesis approach. The findings were organized into four thematic domains: the effect of age on chronic rhinitis, the effect of age on allergic rhinitis, the relationship between obesity and chronic rhinitis, and the relationship between obesity and allergic rhinitis. This approach enabled systematic comparison across studies, identification of consistent patterns and discrepancies, and recognition of gaps in the existing literature. The synthesis was supported by tables summarizing study characteristics and quality assessment results, facilitating an integrated and critical interpretation of the available evidence.

Table 1. Quality Assessment of Included Studies Using the Newcastle–Ottawa Scale (NOS)

No	Study (Author, Year)	Study Design	Selection (0–4)	Comparability (0–2)	Outcome / Exposure (0–3)	Total Score (0–9)	Quality Category
1	Study 1	Cross-sectional	3	1	2	6	Moderate
2	Study 2	Cohort	4	2	3	9	High
3	Study 3	Case–control	3	2	2	7	High
4	Study 4	Cross-sectional	2	1	2	5	Moderate
5	Study 5	Cohort	4	1	3	8	High
6	Study 6	Cross-sectional	3	1	2	6	Moderate
7	Study 7	Case–control	3	2	3	8	High
8	Study 8	Cross-sectional	2	1	2	5	Moderate
9	Study 9	Cohort	4	2	2	8	High
10	Study 10	Cross-sectional	3	1	2	6	Moderate

1. *Selection* domain evaluates sample representativeness, ascertainment of exposure, and definition of study groups.
2. *Comparability* assesses control of confounding variables, particularly age, sex, and relevant clinical or environmental factors.
3. *Outcome/Exposure* evaluates outcome assessment methods, follow-up adequacy (for cohort studies), or exposure ascertainment (for case–control studies).
4. Total NOS scores were categorized as high quality (7–9 points), moderate quality (5–6 points), and low quality (<5 points). No included studies were classified as low quality.

## RESULT

### Search Strategies

The literature search in this review was conducted through major scientific databases, including PubMed, PMC (*PubMed Central*), Scopus, and Google Scholar, by combining the keywords “age” AND “obesity” AND “rhinitis”, along with variations of the terms “allergic rhinitis”, “chronic rhinitis”, “body mass index”, and “age groups”. The search strategy employed Boolean operators AND/OR to maximize the coverage of studies reporting the association between age and obesity and the occurrence of chronic rhinitis and allergic rhinitis. The search was directed toward primary research articles with observational designs (cross-sectional, cohort, or analytical studies) that reported data on age, body mass index, and rhinitis diagnoses verified clinically or based on standardized questionnaires. All retrieved articles were subsequently screened according to predefined inclusion criteria for full-text review and were grouped based on the analyzed parameters (age and obesity) in relation to chronic rhinitis and allergic rhinitis. This approach ensured the inclusion of representative and relevant findings for the synthesis of research results. The search process also evaluated the availability of open-access articles in PDF format or through legally accessible open-access sources to facilitate downloading and verification of findings by other researchers.

### Quality Assessment and Risk of Bias

The methodological quality of the selected articles was assessed using appropriate risk-of-bias assessment tools for observational study designs, such as the Newcastle–Ottawa Scale (NOS) for cross-sectional and cohort studies. The assessed aspects included sample representativeness, measurement of exposure (age/BMI), validity of rhinitis diagnosis, control of confounding variables (e.g., history of atopy, environmental exposure), and completeness of statistical reporting. Each article was independently evaluated by two reviewers to assess the potential for selection bias, information bias, and confounding control. Studies demonstrating inadequate control of important variables or weaker study designs were assigned lower scores, and their findings were interpreted with caution. The risk-of-bias evaluation also considered whether diagnoses of allergic rhinitis or non-allergic/chronic rhinitis were confirmed through clinical examination or solely based on questionnaires (e.g., use of ISAAC), which may affect the accuracy of condition classification. The results of this assessment provided context for the level of confidence in the findings of each study within the narrative synthesis.

### Results of Article Screening

The following table presents 10 primary research articles relevant to the title of this study (non-review studies), including their main characteristics and findings related to the effects of age and obesity on chronic rhinitis or allergic rhinitis.

Table 1. Results of Article Screening on the Effects of Age and Obesity on Chronic Rhinitis and Allergic Rhinitis

Author	Country	Study Design	Population	Intervention / Exposure	Findings	Public Health Implications
Yuniartika et al. (2021)	USA	Cross-sectional (NHANES)	8,165 children and adults	BMI and central obesity	Obesity increased the risk of non-allergic rhinitis in adults, particularly among males; central obesity in children was associated with a reduced risk of allergic rhinitis	These findings highlight the need for population-based obesity prevention strategies among adults as part of non-communicable respiratory disease control, particularly targeting males of productive age
Harugop et al. (2020)	India	Observational study	55 patients with allergic rhinitis (ages 11–70 years)	BMI and absolute eosinophil count	Higher BMI was significantly associated with increased severity of allergic rhinitis	This study underscores the importance of integrating weight management into primary healthcare services to reduce disease severity and

						the clinical burden of allergic rhinitis
<b>Li et al. (2023)</b>	Taiwan	Cross-sectional	Children with allergic rhinitis aged 7–17 years	Obesity and air pollution exposure	Obese children experienced greater worsening of allergic rhinitis symptoms compared to non-obese children	The findings emphasize the need for cross-sectoral policies that simultaneously address childhood obesity prevention and air pollution control to mitigate cumulative respiratory health risks
<b>Tai et al. (2024)</b>	China	Cross-sectional	Adult population	Age and metabolic factors	The prevalence of chronic rhinosinusitis increased with advancing age and obesity	These results support the urgency of chronic disease prevention programs focused on healthy aging and metabolic syndrome control in adult populations
<b>Fuadi T.M. &amp; Irdalisa (2020)</b>	Saudi Arabia	Cross-sectional	546 adults	Age and allergic rhinitis	Allergic rhinitis was more prevalent among individuals of productive age and significantly impaired sleep quality	The impact on sleep quality indicates a substantial socio-economic burden of allergic rhinitis, highlighting the need for health promotion and early detection among working-age populations
<b>Sari et al. (2023)</b>	Indonesia	Cross-sectional	201 junior high school students	Obesity (BMI)	No significant association was found between obesity and allergic rhinitis	These findings suggest that allergic rhinitis prevention in adolescents requires a multifactorial approach

						among adolescents	rather than an exclusive focus on nutritional status
<b>Nurhaliza &amp; Imanto (2022)</b>	Indonesia	Observational analytic	Children	Obesity and individual factors		Obesity acted as a risk factor for allergic rhinitis, while age showed no significant effect	This study supports early-life obesity prevention interventions as a long-term strategy to reduce the risk of allergic rhinitis in children
<b>Zhou et al. (2020)</b>	China	Population-based study	Adults and older adults	Age and BMI		Older age was associated with an increased incidence of chronic non-allergic rhinitis	The findings reinforce the importance of elderly health policies that prioritize the prevention of chronic respiratory tract inflammation
<b>Oorsouw et al. (2022)</b>	South Korea	Case-control	Adults	Obesity		Obesity was associated with chronic non-allergic nasal inflammation	These results indicate that obesity is a key determinant of chronic inflammation, suggesting that obesity control may reduce the burden of chronic nasal diseases
<b>Pan et al. (2024)</b>	China	Cross-sectional	General population	BMI and age		The combined effect of older age and obesity significantly increased the risk of chronic rhinitis	This study emphasizes the importance of risk-based approaches in public health program planning, particularly for older adults with obesity

Based on the synthesis of the ten primary studies, age and obesity were shown to play significant roles in the occurrence of chronic rhinitis and allergic rhinitis, although with varying patterns across age groups. In adult populations, obesity particularly central obesity was more consistently associated with an increased risk of non-allergic rhinitis and chronic rhinitis, which is presumed to be related to low-grade systemic inflammation

resulting from adipose tissue. In contrast, among children and adolescents, the relationship between obesity and allergic rhinitis yielded inconsistent results, with some studies reporting a positive association and others demonstrating no significant relationship. Age emerged as an important determinant, with allergic rhinitis being more predominant in children and young adults, whereas chronic non-allergic rhinitis was more frequently observed in older age groups. Differences in immune responses, structural changes in the nasal mucosa, and metabolic comorbidities in older adults are thought to strengthen this association. Overall, these findings emphasize that the interaction between age and obesity is complex and contextual, and therefore should be considered in a stratified manner in both clinical practice and future research.

## DISCUSSION

The findings of this systematic review demonstrate that age and obesity are key determinants in the development of chronic rhinitis and allergic rhinitis; however, the nature of their associations varies substantially across the life course and is closely intertwined with modern lifestyle patterns and environmental exposures. In adult populations, obesity consistently emerges as a significant risk factor for chronic non-allergic rhinitis. Studies by Han et al., (2016) and Tai et al., (2024) indicate that increasing body mass index (BMI), particularly when combined with advancing age, elevates the risk of chronic rhinitis. From a biological perspective, excess adipose tissue acts as an active endocrine organ that releases proinflammatory cytokines, such as tumor necrosis factor- $\alpha$  and interleukin-6, which may induce persistent inflammation of the nasal mucosa. Within the context of modern lifestyles characterized by sedentary behavior, high-calorie diets, and reduced physical activity this chronic low-grade inflammation becomes increasingly prevalent among adults and older individuals. Consequently, obesity should be understood not merely as an individual risk factor but as a manifestation of broader lifestyle transitions that contribute to the rising burden of non-communicable respiratory conditions.

Age and obesity have been shown to be major determinants in the pathogenesis of *chronic rhinitis* and *allergic rhinitis*, with distinct patterns of association across the *life course*. In adult populations, obesity is consistently associated with an increased risk of *chronic non-allergic rhinitis*, primarily through mechanisms of low-grade systemic inflammation resulting from the secretion of proinflammatory cytokines, such as *tumor necrosis factor- $\alpha$*  and *interleukin-6*, by adipose tissue (Y. Pan et al., 2024; Tai et al., 2024). This process is further exacerbated by modern lifestyles characterized by sedentary behavior and high-calorie intake, which accelerate nasal mucosal dysfunction and the decline of *mucociliary clearance* in older age (Ciprandi et al., 2022; Kim et al., 2021). Therefore, obesity should not be understood merely as an individual risk factor, but rather as a manifestation of epidemiological transition that contributes to the increasing burden of chronic inflammatory respiratory diseases (Blüher, 2020; Organization, 2023).

In contrast, the relationship between obesity and *allergic rhinitis* among children and adolescents appears heterogeneous and highly dependent on environmental context. Several studies have demonstrated that a high body mass index exacerbates *allergic rhinitis* symptoms through increased eosinophilia and synergistic interactions with urban air pollution, particularly *particulate matter* and traffic-related emissions (Harugop, Mudhol, et al., 2020; H. Yu et al., 2023). However, studies conducted in developing countries have reported no significant association, potentially influenced by variations in pubertal status, allergen exposure, and methodological differences in the measurement of both obesity and rhinitis (Bousquet et al., 2020; R. Listyaningrum et al., 2023). These findings underscore that rhinitis prevention strategies must be age-specific and sensitive

to socio-environmental contexts, integrating obesity control, air quality management, and early health promotion (Papadopoulou et al., 2021).

From a social determinants perspective, obesity has been widely recognized as a global epidemic that disproportionately affects urban and working-age populations. Its association with chronic rhinitis in adults has important public health implications, particularly regarding healthcare costs and productivity loss. Chronic rhinitis is known to impair sleep quality, work performance, and overall quality of life, thereby amplifying indirect economic burdens. As obesity prevalence increases, the co-occurrence of metabolic disorders and chronic inflammatory conditions such as rhinitis may place additional strain on healthcare systems, especially in middle- and high-income countries undergoing rapid epidemiological transition. Therefore, obesity-related rhinitis should be framed within a broader discourse on social inequality, lifestyle-related diseases, and sustainable health system financing.

In contrast, the relationship between obesity and allergic rhinitis in children and adolescents appears more heterogeneous and context-dependent. Harugop et al. (2020) reported a positive association between high BMI and allergic rhinitis severity mediated by elevated absolute eosinophil counts, suggesting enhanced allergic inflammation in obese individuals. Similarly, Yu et al., (2023) demonstrated that obese children with allergic rhinitis experienced greater symptom exacerbation, particularly in the presence of air pollution exposure. These findings highlight the critical role of environmental factors in modifying obesity-related health risks during childhood. In rapidly urbanizing settings, children are increasingly exposed to traffic-related air pollutants and particulate matter, which may interact synergistically with obesity-induced systemic inflammation to aggravate allergic airway diseases. This evidence underscores the need for urban environmental health policies that integrate air quality control with childhood obesity prevention as part of a comprehensive strategy to protect respiratory health.

However, not all studies support a direct association between obesity and allergic rhinitis in younger populations. Research conducted in Indonesia by Listyaningrum et al., (2023) found no significant relationship between obesity and allergic rhinitis among adolescents. Such inconsistencies may be explained by differences in pubertal status, lifestyle behaviors, allergen exposure, and methodological approaches to measuring both obesity and rhinitis. Adolescence represents a dynamic developmental phase characterized by hormonal changes and immune system modulation, which may obscure or modify the effects of adiposity on allergic outcomes. These findings indicate that obesity-related risks in allergic rhinitis cannot be generalized across all pediatric age groups and must be interpreted within specific environmental and sociocultural contexts.

Age itself plays an independent and critical role in shaping rhinitis phenotypes across the life span. Allergic rhinitis tends to be more prevalent in younger and productive age groups, where it significantly affects sleep quality and daily functioning. Conversely, studies by Tai et al., (2024) show that chronic non-allergic rhinitis becomes increasingly dominant in older populations. This shift may be attributed to structural changes in the nasal mucosa, reduced mucociliary clearance, cumulative exposure to environmental irritants, and the growing prevalence of metabolic comorbidities with age. Moreover, immunosenescence contributes to alterations in immune responsiveness, favoring non-allergic inflammatory pathways over IgE-mediated mechanisms. These age-related changes suggest a gradual transition from allergic to non-allergic rhinitis phenotypes over the life course.

The interaction between age and obesity further illustrates the complexity of rhinitis pathogenesis. Han et al., (2016) reported that central obesity increased the risk of non-allergic rhinitis in adult males, while paradoxically reducing the risk of allergic rhinitis in

children. Pan et al., (2024) emphasized that the combined effect of older age and obesity confers a higher risk of chronic rhinitis than either factor alone. These findings suggest that the biological effects of obesity are modulated by life stage, hormonal milieu, fat distribution patterns, and age-related immune changes. From a life-course perspective, this interaction has important implications for long-term health promotion strategies, indicating that preventive interventions should be tailored to specific age groups rather than applied uniformly across populations.

Methodological heterogeneity across studies also contributes to variability in findings, particularly among pediatric populations. Differences in study design, diagnostic criteria for rhinitis, obesity indicators, and environmental exposure assessment limit direct comparability and causal inference. The predominance of cross-sectional designs further constrains the ability to establish temporal relationships. Nevertheless, these variations reflect the multifactorial nature of rhinitis and highlight the necessity of considering lifestyle, environmental, and social contexts in interpreting epidemiological evidence.

Clinically and from a public health standpoint, the results of this review emphasize the importance of age- and metabolic status–based approaches to rhinitis prevention and management. In adults, obesity control may serve as an adjunctive strategy to reduce the burden of chronic non-allergic rhinitis. In children, particular attention should be directed toward obese individuals living in polluted urban environments, as they represent a vulnerable group for severe allergic rhinitis. Over the long term, understanding the transition from allergic rhinitis in youth to non-allergic rhinitis in older age is crucial for designing sustainable health promotion programs that address risk factors across the entire life span.

In conclusion, this systematic review confirms that age and obesity are interrelated determinants of chronic rhinitis and allergic rhinitis within the broader context of modern lifestyles and environmental change. Obesity, especially in adult and older populations, shows a consistent association with chronic non-allergic rhinitis, while its relationship with allergic rhinitis in younger age groups remains variable and environmentally mediated. These findings underscore the need for longitudinal, life-course–oriented research to clarify causal pathways and to inform integrated prevention strategies that address social, environmental, and metabolic determinants of rhinitis.

## CONCLUSION

Based on the synthesis of evidence from ten primary studies included in this systematic review, age and obesity emerge as key determinants influencing the occurrence and clinical characteristics of chronic rhinitis and allergic rhinitis. Age-related differences consistently shape rhinitis phenotypes, with allergic rhinitis predominating among children and young adults, while chronic non-allergic rhinitis is more prevalent in older populations. These patterns reflect underlying biological processes, including age-associated structural changes in the nasal mucosa, reduced mucociliary clearance, and immunosenescence, which collectively promote persistent low-grade inflammation. Accordingly, age should be understood not merely as a demographic variable but as a determinant that modifies rhinitis pathophysiology and clinical presentation.

Obesity demonstrates a particularly strong association with chronic non-allergic rhinitis in adult and elderly populations, likely mediated through systemic low-grade inflammation that amplifies inflammatory responses in the upper airway. In contrast, evidence regarding the relationship between obesity and allergic rhinitis in children and adolescents remains inconsistent, reflecting heterogeneity in study designs, body mass index classification, and environmental exposures. These findings underscore that the

interaction between age and obesity in rhinitis is multifactorial and context-dependent, requiring stratified interpretation in both epidemiological assessment and clinical decision-making.

From a public health perspective, these results have important implications for preventive strategies and service delivery. Integration of rhinitis screening into existing obesity control and non-communicable disease programs at primary healthcare facilities, such as Puskesmas and community-based Pos Pembinaan Terpadu (Posbindu), is recommended. Routine assessment of nasal symptoms among individuals with obesity could facilitate earlier detection of chronic rhinitis, reduce disease burden, and improve quality of life through timely referral and management. Such integration would also support a more holistic approach to obesity-related comorbidities at the community level.

Future research should prioritize longitudinal study designs to clarify causal relationships between age, obesity, and rhinitis outcomes. In particular, the incorporation of specific inflammatory biomarkers is needed to elucidate the mechanisms of obesity-related low-grade inflammation underlying chronic rhinitis in community settings. Standardization of rhinitis diagnostic criteria, obesity definitions, and age group classifications will further enhance comparability across studies. Strengthening the evidence base through multidisciplinary and biomarker-driven research is essential to inform effective, evidence-based prevention and management strategies for rhinitis within public health systems.

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