

Beyond the Red Face: A Global Odyssey into Rosacea-Prevalence, Triggers, and Treatment Trends

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Abstract

Background: Rosacea is a chronic inflammatory dermatosis that is defined by recurrent facial erythema, papules, pustules, and telangiectasia. Even with growing world-wide acceptance, there are still significant knowledge gaps regarding the epidemiologic heterogeneity, risk factors, and best management practice, particularly in underrepresented ethnic groups. **Aim and Objective:** The aim of this systematic review and meta-analysis was to find demographic trends, clinical presentation, rosacea risk factors, and response to treatment in populations globally and by ethnicity and to answer the question: What are the worldwide clinical features, risk factors, and response to treatment in rosacea, and how do these differ in populations? **Material and Methods:** The databases of PubMed, Scopus, Embase and Google Scholar were searched for publications between 2017-2025 and finally 10 studies were included in the systematic review of which three were included in the meta analyses. Data that were extracted were study design, geographic region, demographics, rosacea subtypes, comorbidities, treatments, and risk factors associated. Pooled prevalence proportions and effect sizes were estimated using random-effects meta-analysis models where necessary. Heterogeneity was estimated using I^2 statistics. R Studio was used for data analysis and graphical preparations. **Results:** The pooled estimate came out to be 2% (95% CI: -0.02 to 0.06). Female predominance varied from 64%–84%, and erythematotelangiectatic rosacea was the most prevalent subtype. Sun exposure (OR=4.2), temperature changes (OR=3.6), and oily skin (OR=6.3, $p<0.001$) were all risk factors identified consistently. There was a remarkable regional variation in presentation and distribution of subtypes. Treatment responses were biased towards systemic antibiotics and intense pulsed light (IPL) laser in some subgroups. **Conclusion:** This review emphasized upon considerable worldwide heterogeneity in rosacea epidemiology, presentation, and responsiveness to treatment and underscored the necessity of region-specific recommendations along with increased focus on the individualized approach, particularly in darker-skinned populations.

Keywords: Rosacea; Epidemiology; Risk factors; Prevalence; Systematic Review; Meta-analysis

Introduction

Rosacea is an adult-onset, recurrent inflammatory dermatosis that predominantly involves the central facial area and is characterized by the signs of chronic erythema, papules, pustules, telangiectasia, and phymatous changes. Occurring in about 5%–10% of Caucasoid populations, rosacea has traditionally been regarded as a middle-aged Caucasian disorder (Al Balbeesi AO, Halawani MR, 2014). More recent studies indicate an increasing incidence in Asian, Middle Eastern, and darker-skinned populations, necessitating newer research on its clinical patterns, risk factors, and response to treatment.

The economic burden of rosacea worldwide is immense-not only because of its cutaneous manifestations but also because of its psychosocial burden. Patients become withdrawn, shy, and anxious. Increasing evidence identifies associations between rosacea and systemic comorbidities such as autoimmune, cardiovascular, and gastrointestinal diseases.

New etiologies for environmental causes such as sun, heat, and spicy foods are identified. However, significant contributing factors are also the practice of skin care, the use of cosmetics, and emotional stress (Crawford GH *et al.*, 2004). Despite these results,

we still do not have complete knowledge of trends across various populations, risk factors, and responses to treatment.

Secondly, treatment options are increasing. They involve systemic antibiotics, creams, and phototherapies (Two AM *et al.*, 2015). Nevertheless, the level of usefulness of such treatment options may vary depending on the type of rosacea as well as the patient.

This review and analysis seeks to bridge these gaps by gathering new evidence from around the globe. The research seeks to provide strong, evidence-based facts regarding rosacea's global patterns, symptoms, associated factors, and outcomes of treatment. With such a strategy, we seek to enable physicians to learn about new trends and develop precise, evidence-based treatments for the management of rosacea.

Methodology

This systematic review and meta-analysis followed a predefined protocol to identify, select, and synthesize relevant studies on rosacea.

Study Design

Systematic review and meta analyses

Study Period

Studies published between the year 2017 to 2025.

Sample size

A total of 62359 subjects were included.

Search Strategy

A comprehensive search was conducted across electronic databases including PubMed, Scopus, Embase, and Google Scholar to identify peer-reviewed articles on rosacea, where the search terms included “epidemiology”, “risk factors” and “prevalence”. The search was limited to studies published between 2017 to 2025. Finally, 10 studies were selected for the systematic review and three for meta-analyses using the Preferred Reporting Item for Systematic Review and Meta Analyses (PRISMA guidelines) (Figure 1) (Tetzlaff J *et al.*, 2020).

Eligibility**Inclusion Criteria**

- Studies published between 2017 and 2025
- Original research on rosacea epidemiology, risk factors, or treatments
- Studies reporting numerical data on prevalence, risk factors, or treatment outcomes
- English-language articles

Exclusion Criteria

- Case reports, reviews, and editorials
- Studies lacking full text
- Articles with incomplete data or methodological flaws

Study Selection

Titles and abstracts of identified articles were independently screened by two reviewers (A.S. and M.K.) based on the inclusion and exclusion criteria. Full-text articles of potentially relevant studies were then retrieved and assessed for eligibility. Discrepancies were resolved through discussion and consensus.

Quality Assessment

The quality of included studies was assessed using appropriate tools relevant to their study design using the New Castle Ottawa Scale. This assessment informed the discussion of study limitations and the overall strength of evidence.

Data Synthesis and Meta-Analysis

A narrative synthesis was performed to summarize qualitative findings across studies. For quantitative data for rosacea, the prevalence proportion was taken as effect size, a meta-analysis was conducted for three studies using a random-effects model to account for heterogeneity across studies. Pooled proportions and 95% confidence intervals were calculated. Heterogeneity was assessed using the I^2 statistic.

The first author name with year of publication, study design, country, sample size, study characteristics and key findings were tabulated (Table 1).

Data Sources and Extraction

Data were extracted from 10 eligible studies across Asia, Europe, and the Middle East. Information was retrieved on demographics, study designs, and clinical associations with rosacea and Microsoft Excel version 16 was used for data input. R Studio was used for data analysis and graph preparations.

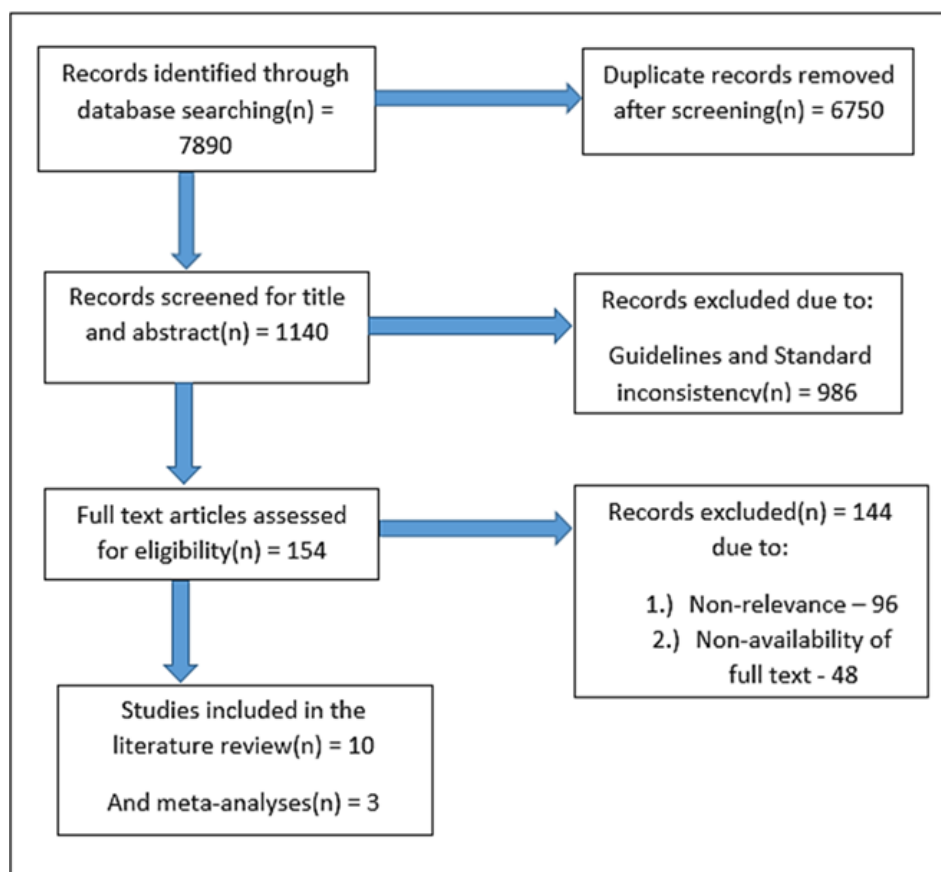


Figure 1: Flowchart for systematic review and meta analyses

Results

Screening Flow

A total of 7890 articles were retrieved from electronic databases of PubMed, Scopus, Embase and Google scholar from 2017-2025. About 6750 duplicated were excluded and the remaining 1140 articles were assessed for title and abstract screening of which 986 articles were excluded. The remaining 154 articles were analysed for full text screening out of which 144b articles were excluded. Finally, a total of 10 articles were included for the systematic review with a subject of 62359 and 3 articles were considered for the meta analyses.

The sample size, effect size in proportion, standard error, lower and upper CI (95%) were tabulated for the meta analyses of three studies (Table 2). Erythematotelangiectatic rosacea was reported as the common subtype (52%-74% across studies). There was a female predominance in the studies (64%-84%). Hypertension (4.2%-7.5%) and autoimmune disorders (2%-4.2%) were reported as the most common comorbidities. Oily skin (OR=6.3, $p<0.001$), temperature variations (OR=3.6) and sun exposure (OR=4.2) showed the strongest association with the condition as risk factors.

The forest graph was plotted wherein the pooled estimate came out to be 2% (95% CI: -0.02 to 0.06) (Figure 2). The overall heterogeneity (I^2) was highly significant with a value of 99.88% with a p value < 0.001 indicating that the studies measured different

underlying effects instead of variation around the true effect. Due to the small number of studies taken into consideration, the power to detect publication bias was limited.

Funnel's and Egger's Test

The funnel plot came out to be asymmetrical attributed to the geographical and chronological variations (Figure 3). The egger's test p value came out to be 0.0319 with a degree of freedom equal to 1. The t-statistic rendered a value of 19.959 and an intercept of -6.5353 was noted (bias coefficient). The standard error for the intercept was 0.3274.

The bubble meta regression graph was plotted (Figure 4). The intercept was approximately 0.7% representing the estimated baseline prevalence when the sample size reached zero. The 95% CI appeared to cross this value around 700-1000 on the sample size axis. The extremely small slope of $4.5096e-07$ indicated a very weak positive relationship. The prevalence increased by approximately 0.05% for every 1000 increase in sample size. The regression line intersected the confidence intervals of individual studies around the sample ranges (lower crossed approximately at sample size of 1000 and upper ci crossed at a sample size of 2500-3000). Overall, the meta regression indicated a very weak positive correlation between sample size and prevalence estimates. However, again this relationship needs to be interpreted cautiously due to the inclusion of a small number of studies.

Table 1: Study Characteristics

First Author (Year)	Study Design	Country	Gender Ratio (F:M)	Mean Age	Comorbidities	Sample Size	Important Findings
Mauro Picardo <i>et al.</i> (2017)	Observational cohort	Italy	68:32	42	Not specified	322	Oxidative stress implicated in rosacea pathogenesis
Jee Hee Son <i>et al.</i> (2018)	Retrospective cohort	South Korea	Mixed	~48	CVD, DM, Hypertension	2536	Diabetes (OR 2.72), beta-blockers (OR 5.1) increase rosacea risk
Yu Ri Woo <i>et al.</i> (2019)	Retrospective cohort	South Korea	~70:30	45	Not detailed	56,651	Increasing trends of rosacea visits, esp. in 40–59 age group
Zhao <i>et al.</i> (2020)	RCT	China	45:20	40	Not reported	65	Intense pulsed light (IPL) significantly reduces erythema in mild-moderate erythematotelangiectatic rosacea (ETR)
Huang <i>et al.</i> (2020)	Case-control	China	~75:25	37	Dermatologic	1252	Certain skincare habits (e.g., frequent facial masks) strongly associated with rosacea onset
Altınışık <i>et al.</i> (2023)	Retrospective	Turkey	168:94	30	Acne	262	38.2% prevalence of rosacea among patients with chronic facial erythema
Guertler <i>et al.</i> (2023)	Cross-sectional	Germany	Mixed	35	Insulin resistance	296	Significant link between dietary patterns and rosacea occurrence
Zhao <i>et al.</i> (2020 1)	RCT	China	Mixed	NA	Not specified	150	Laser therapy improved ETR subtype features
Huang <i>et al.</i> (2025)	Retrospective	China	100% Male	38.6	Systemic (14%)	215	Nasal lesions predominant; older patients had more severe presentations
Alshiyab <i>et al.</i> (2025)	Retrospective cohort	Jordan	84:16	44	Autoimmune 4.2%, CV, GI, Resp	610	Prevalence 1.5%; ETR predominant; 65.7% misdiagnosis rate

Table 2: Meta-Analysis Results

First Author (Year)	Sample Size	Prevalence (Proportion)	SE	95% CI Lower	95% CI Upper
Jee Hee Son <i>et al.</i> (2018)	2536	0.0018	0.0004	0.0010	0.0026
Yu Ri Woo <i>et al.</i> (2019)	56,651	0.034	0.0007	0.033	0.035
Alshiyab <i>et al.</i> (2025)	610	0.015	0.0005	0.014	0.016

Table 3: Merits and Gaps

First Author (Year)	Merits	Gaps
Mauro Picardo <i>et al.</i> (2017)	Introduced oxidative stress mechanisms	Small sample, lacks longitudinal outcomes
Jee Hee Son <i>et al.</i> (2018)	Large database, CVD associations analyzed	No stratification by rosacea subtype
Yu Ri Woo <i>et al.</i> (2019)	Massive dataset, clear prevalence trends	Lacked granular clinical severity detail
Zhao <i>et al.</i> (2020)	RCT, strong methodology	Limited generalizability, small sample
Huang <i>et al.</i> (2020)	Largest study on skincare habits	Self-reporting bias possible
Altınışık <i>et al.</i> (2023)	Useful for "red face" differential diagnosis	Retrospective, lacking systemic analysis
Guertler <i>et al.</i> (2023)	Dietary influence robustly shown	Recall bias on food intake
Zhao <i>et al.</i> (2020 1)	RCT, laser treatment validated	Narrow patient pool, lacks long-term data
Huang <i>et al.</i> (2025)	Rare male-focused study	Focused only on males
Alshiyab <i>et al.</i> (2025)	Rare Fitzpatrick III-IV study, large cohort	Single center, retrospective design

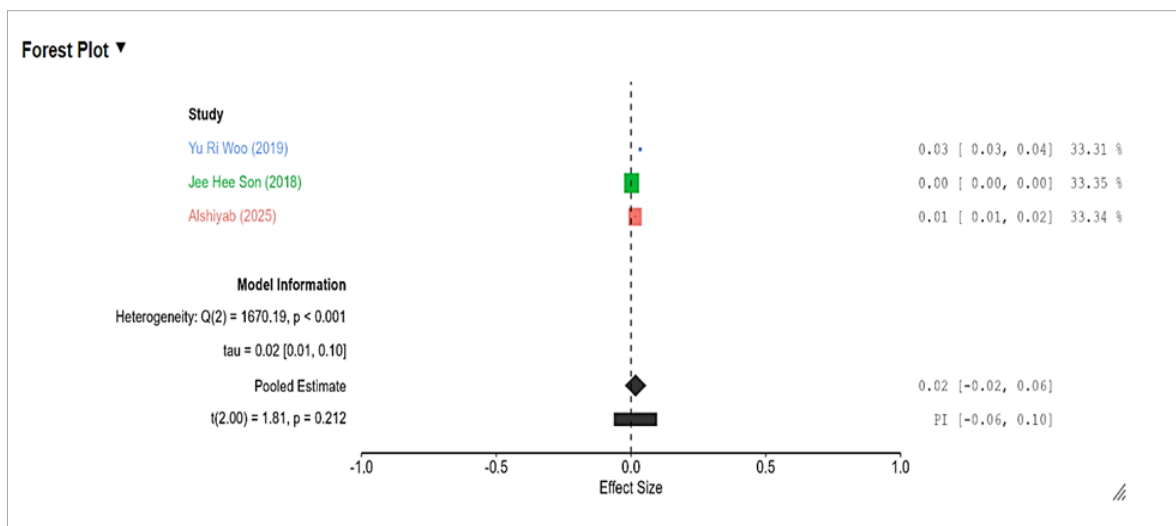


Figure 2: Forest plot the meta analyses on the prevalence of rosacea

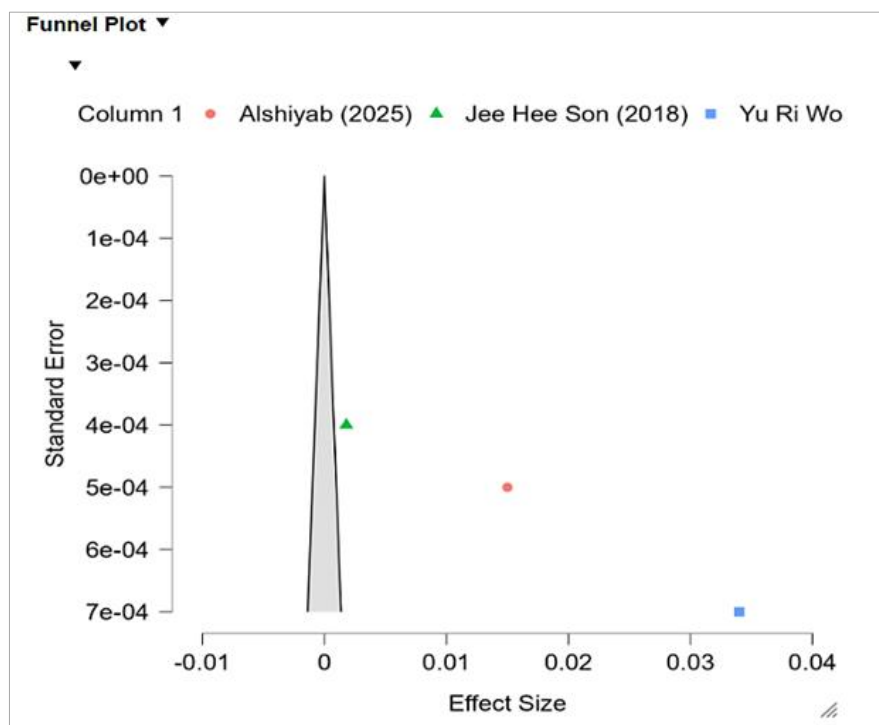


Figure 3: Funnel plot for the meta analyses on the prevalence of rosacea

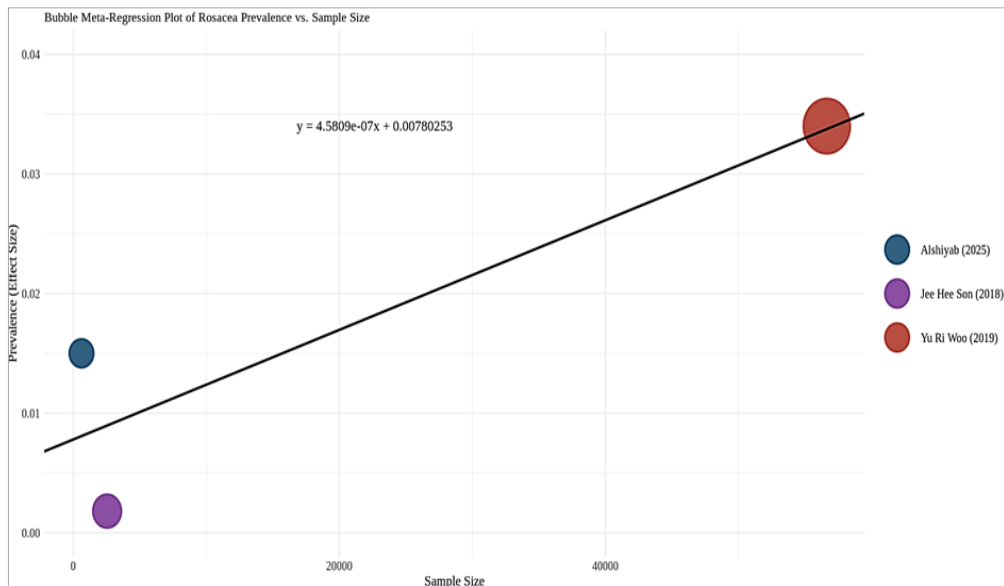


Figure 4: Bubble meta regression plot



Figure 5: Triggering factors of rosacea

Discussion

An author highlighted oxidative stress as a major pathogenic agent and explained elevated lipid peroxidation products in patients (Picardo M *et al.*, 2017). With 322 participants in the cohort, this study placed molecular underpinnings on the table but was not comprehensive in terms of geographic and ethnic representation. The etiology of rosacea was further discussed in another study (Buechner SA, 2005).

Broadening the clinical spectrum, another author conducted a large retrospective study of 2,536 rosacea patients in South Korea (Son J.H. *et al.*, 2018). This seminal paper brought high degrees of association with systemic comorbidities, with an odds ratio (OR) of 2.72 (95% CI 1.29–5.73) for diabetes mellitus, and an OR of 5.1 (95% CI 4.4–5.9) with the use of beta-blockers as being important factors of rosacea risk. This study thus shifted the emphasis of rosacea studies from dermatology-based to include more systemic health factors. Rosacea was correlated with diabetic macular edema, glaucoma, dry eye disease, and cataract development in diabetic

patients, and increased incidences of psoriasis, irritable bowel syndrome, anxiety, and depression in diabetic patients (Wang F Y *et al.*, 2022).

Another author added in 2019 an impressive dataset of 56,651 outpatient visits, showing a dramatic increase of hospital visits from 2,456 to 6,985 per year in Korea (Woo YR *et al.*, 2019). The frequency was highest in females aged 40–59, confirming gender and age patterns. As for prescriptions, systemic antibiotics were most commonly prescribed, followed by antihistamines, non-steroidal anti-inflammatory drugs, and retinoids. Among the topical agents, metronidazole was the most prescribed agent during 2007–2012, whereas calcineurin inhibitors were favoured most during 2013–2018 in the study. In another study, it was stated that erythematotelangiectatic rosacea was more in females however, phymatous rosacea was more prevalent in males (Barakji YA *et al.*, 2022).

Another author redirected the attention to therapeutics by performing a randomized controlled trial on 65 Chinese patients, and they reported that treatment with IPL significantly reduced

erythematous scores ($p < 0.01$), particularly in patients with mild to moderate erythematotelangiectatic rosacea (ETR) (Zhao L *et al.*, 2020). This was further corroborated upon in another study (Ruan J *et al.*, 2024).

Following environmental factors, another study utilized a big sample case-control survey ($n = 1,252$) that determined habitual overuse of facial cleansers ($OR = 2.13$, $p < 0.001$) and regular facial mask usage ($OR \approx 3.0$, $p < 0.001$) were positively associated with rosacea. Conversely, sunscreen was protective ($OR = 0.30$, $p < 0.001$) (Huang YX *et al.*, 2020). This was further supported by another study (Li G *et al.*, 2021).

Another author in our systematic review investigated 262 dermatology patients with "red face" complaints and revealed that 38.2% of them had rosacea, demonstrating the diagnostic challenge of erythematous dermatoses in dermatology clinics (Altınışık DD *et al.*, 2023).

Another author in Germany offered a nutritional viewpoint by stating 80.8% of rosacea patients experienced dietary impacts, with dairy and processed carbohydrates worsening their symptoms (Guertler *et al.*, 2023). Notably, the levels of IGF-1 were high ($p = 0.006$) in patients whose diets included dairy, perhaps explaining one biochemical mechanism. Similar findings echoed in another study (Searle T *et al.*, 2021).

Along with reaffirming the significance of light therapies, another author also presented an independent randomized trial that confirmed the effectiveness of laser therapy in enhancing the vascular characteristics of ETR (Zhao L *et al.*, 2020).

Referring to male population data, another author had performed a retrospective analysis in 215 Chinese male patients, with a presentation of 58.6% nasal involvement, which was different from their prior female-dominant studies and indicating gender-dependent phenotypic differences (Huang Y *et al.*, 2025). Similar findings echoed in another study (Wu AK *et al.*, 2021).

Last but not least, another author provided a Middle Eastern view by studying 610 Jordanian patients. They reported a prevalence of rosacea to be 1.5% with recurrent erythema present in 87.4% of the patients. Interestingly, they reported a 65.7% rate of misdiagnosis before dermatological consultation with diagnostic delay in Fitzpatrick III-IV skin types (Alshiyab D *et al.*, 2025). Another study threw light upon this further (He G *et al.*, 2024).

Together, these studies uncover a complex interaction among genetic, environmental, hormonal, metabolic, and cultural determinants of rosacea that demands global, multidisciplinary efforts to increased awareness and care.

Further, tea drinking patterns were associated with rosacea. This was stated in a study (Ben WA *et al.*, 2021). The triggering factors for the development and aggravation of rosacea were further illustrated (Figure 5).

It was further confirmed that *H. pylori* infection is involved in the development of rosacea in a study (Yang X, 2018).

The merits and gaps for each study included in the systematic review were tabulated (Table 3).

Conclusion

Rosacea is no longer a disease reserved for European populations or dermatology texts. This systematic review and meta-analysis illustrated how the clinical signature of rosacea is shaped by regional, demographic, lifestyle, and systemic health determinants. Although oxidative stress and inflammation are constant themes, new evidence on the role of diet, drug associations, and underappreciated male presentations has updated our understanding.

Greater than ever before, clinicians must consider beyond the skin when diagnosing rosacea, including comorbid cardiovascular risk, systemic disease, and psychosocial burden. Misdiagnosis remains too prevalent, particularly among darker skin types, validating the need for increased diagnostic education globally, now.

Rosacea treatment in the future will require multidisciplinary models of care that integrate dermatologic, nutritional, endocrinologic, and psychological expertise. Multicenter, longitudinal, and ethnically diverse studies will be required to close the gaps recorded here. New therapies directed at oxidative pathways, vascular processes, and the skin microbiome are promising but will need to be tested in other populations.

No longer "just a red face," rosacea is today a global dermatologic issue, and this review is a call to arms for individualized, integrated, and globalized care approaches in the future.

Strengths and Limitations

The major strength of the study was that it included diverse geographic populations and integrated epidemiological, clinical, environmental and therapeutic insights. Rosacea's full complexity was captured with this analysis by incorporating both small focused trials and massive retrospective cohorts. However, the major limitations included reporting of a statistically high heterogeneity of 99.88%, reliance on retrospective data and variability in diagnostic criteria across population weakening comparability, highlighting on the need for global consensus in the classification framework of rosacea.

Declarations

Ethical Approval

Not Required since the study conducted was a systematic review and meta-analyses and included the studies selected from 2017-2025.

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Conflicts of Interests

The authors report no conflict of interest.

Author Contributions

Conceptualization and methodology A.S., and M.K.; Formal analysis, A.S., and M.K.; Visualization and writing -original draft A.S., and M.K.; Writing -review and editing A.S., M.K. and J.H., and J.H. All authors have read and agreed to the final version of the manuscript.

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