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Association between Life's Essential 8 as an indicator of cardiovascular health with risk of rheumatoid arthritis and osteoarthritis; a systematic review and meta-analysis

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Abstract

Introduction: Rheumatoid arthritis (RA) and osteoarthritis (OA) are the most common forms of arthritis. On the other hand, lifestyle-related behaviors are associated with cardiovascular and autoimmune diseases. Hence, the present study aimed to examine the relationship between increased Life's Essential 8 (LE8) scores and reduced risk of RA and OA.

Materials and Methods: In the present study, databases including Cochrane, Scopus, Web of Science, Embase, PubMed, and Google Scholar search engine were conducted to retrieve the required articles published by February 20, 2026. Data extracted from the reviewed studies were entered into SPSS 19 and analyzed using Stata 14.

Results: Increased LE8 scores reduced the risk of RA (OR: 0.88, 95% CI: 0.78, 1.00) and OA (OR: 0.87, 95% CI: 0.78, 0.97). A moderate level of LE8 compared with a low level (OR: 0.67, 95% CI: 0.60, 0.75) and a high LE8 level compared with a low level (OR: 0.50, 95% CI: 0.45, 0.54) reduced the risk of RA and OA. Furthermore, increased LE8 scores in women (OR: 0.66, 95% CI: 0.54, 0.81), men (OR: 0.67, 95% CI: 0.52, 0.86), cross-sectional studies (OR: 0.84, 95% CI: 0.80, 0.87), cohort studies (OR: 0.90, 95% CI: 0.85, 0.94), the USA (OR: 0.92, 95% CI: 0.90, 0.95), and the UK (OR: 0.84, 95% CI: 0.83, 0.85) reduced the risk of RA and OA.

Conclusion: Increased LE8 scores reduced the risk of RA and OA by 12% and 13%, respectively, and higher LE8 scores led to greater percentages of prevention against RA and OA. Additionally, there was no significant difference between men and women regarding the association between increased LE8 scores and reduced risk of RA and OA.

Registration: This study has been compiled based on the PRISMA checklist, and its protocol was registered on the PROSPERO (ID: CRD420261376295) and Research Registry (UIN: reviewregistry2097) websites.

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Introduction

Arthritis is an inflammatory symptom characterized by joint pain, swelling, stiffness, and limited range of motion. Arthritis includes several types: rheumatoid arthritis (RA), osteoarthritis (OA), gout arthritis, and systemic lupus erythematosus (SLE) arthritis, among which, RA and OA are the most common (1). Osteoarthritis is caused following a lack of balance between articular tissue degradation and regeneration (2). Furthermore, OA is the fourth primary cause of disability worldwide (3), as in 2020, approximately 595 million individuals around the world had OA, accounting for 7.6% of the global population (4). RA is a systemic autoimmune disease, usually affecting individuals aged 50 to 60. It is anticipated that RA has affected approximately 0.25% to 1% of the global population (5,6).

Studies have long suggested that lifestyle-related behaviors (such as inappropriate diet, insufficient physical activity, smoking, and obesity) are associated with the onset of cardiovascular and autoimmune diseases (7-11). For instance, RA shares predisposing factors with cardiovascular

Key point

We found that higher Life's Essential 8 (LE8) scores are associated with a lower risk of both rheumatoid arthritis and osteoarthritis, reducing incidence by 12% and 13%, respectively. The protective effect strengthened progressively with increasing LE8 scores, underscoring the importance of comprehensive cardiovascular and lifestyle health in preventing these joint diseases. Notably, the associations were similar in men and women, suggesting that the benefits of improved LE8 metrics apply broadly across sexes. Collectively, these findings highlight the potential of optimizing LE8 components as a meaningful strategy for reducing the burden of arthritis in the general population.

diseases, including obesity, tobacco, and alcohol use, while simultaneously, they share similar pathophysiological mechanisms (12,13). On the other hand, Life's Essential 8 (LE8) index, defined by the American Heart Association, provides a comprehensive evaluation of cardiovascular health. This index includes eight essential components (diet, physical activity, sleep quality, exposure to nicotine, body mass index (BMI), blood pressure (BP), blood glucose and cholesterol levels) (14,15). Based on the evaluation of LE8 scores, individuals' cardiovascular health is classified into low, moderate, and high (16, 17). Accordingly, the present study aimed to examine the relationship of increased LE8 scores and reduced risk of OA and RA.

Materials and Methods

Study design

The protocol of the current study was developed based on Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) (18), and registered with the PROSPERO (International Prospective Register of Systematic Reviews) and Research Registry websites.

Search strategy

In this study, the following databases were used to find articles published up to February 20, 2026: Cochrane, Scopus, Web of Science, Embase, PubMed, and Google Scholar search engine. The literature search process was conducted without time or language restrictions. The search was carried out using standard keywords and their MeSH (Medical Subject Headings) equivalents. The operators (AND, OR) were used during the advanced search stage to combine the keywords. The list of the selected studies was reviewed to perform a manual search.

PECO framework

Population: Studies that investigated the association of LE8 scores and the risk of RA and OA.
Exposure: Moderate or high LE8 scores.
Comparison: Low LE8 scores.
Outcome: The risk of RA and OA.

Inclusion criteria

Studies that examined the relationship between LE8 and the risk of RA and OA.

Exclusion criteria

Studies that generally suggested the association between LE8 scores and the risk of arthritis and did not provide separate data on RA and OA, meta-analysis studies, articles that lacked the necessary data for analysis, narrative literature reviews, studies whose full texts were not accessible despite contacting the authors via email, duplicate studies, and those without acceptable quality in the quality assessment stage.

Quality assessment

Two authors examined the quality of the studies using the Newcastle-Ottawa Scale (NOS). This tool consisted of 9 questions answered by assigning stars (19). Studies that achieved a minimum of 6 stars (*) were assumed high-quality and were included in the present meta-analysis.

Data extraction

Two authors designed a single form and entered the data extracted from the studies into the form using SPSS 19 software. The extracted data included author's name, study time, publication year, study location and type, mean age of participants, type of disease (RA or OA), achieved LE8 score, and the risk of RA and OA.

Statistical analysis

The log transformation of odds ratio (OR) was used to combine the reviewed studies. The I^2 index was conducted to examine the heterogeneity of investigation. Accordingly, a fixed effects model was carried out for cases with low heterogeneity and a random effects model was used for cases with moderate to high heterogeneity. Statistical analysis was conducted using STATA 14 software, and the significance level was set at $P < 0.05$.

Results

A total of 157 articles were found through searching the databases. After the titles were reviewed, 88 duplicate articles were removed. Abstracts of the remaining 69 articles were examined, and 31 studies that lacked the necessary data for analysis were excluded. Among the 38 articles that proceeded to the next stage, full texts of 11 articles were not accessible and were therefore removed. Another 18 studies were excluded due to other exclusion criteria, and 9 articles remained (Figure 1).

The present meta-analysis investigated 9 studies, including 5 cross-sectional and 4 cohort studies. Table 1 presents a portion of the most significant data extracted from the reviewed studies.

Primary outcome

Increased LE8 score reduced the risk of RA (OR: 0.88, 95% CI: 0.78, 1.00) and OA (OR: 0.87, 95% CI: 0.78, 0.97) (Figure 2).

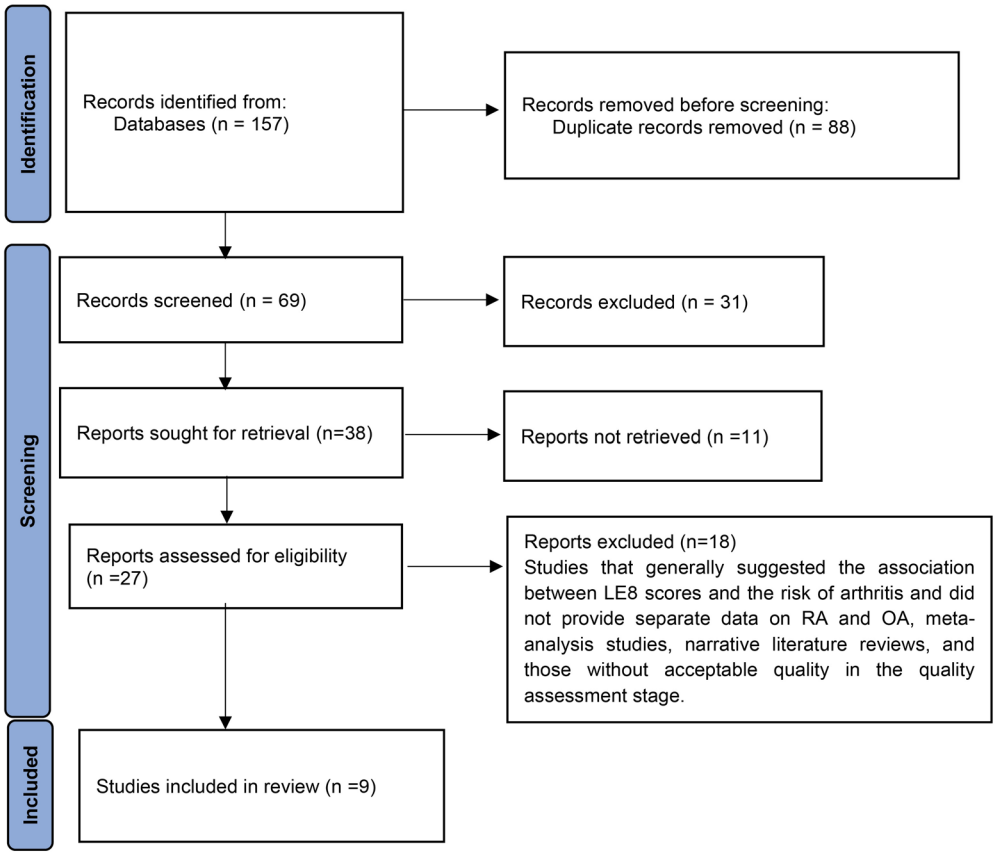

Figure 1. The PRISMA flowchart of study selection.

Subgroup analysis

Increased LE8 score in cross-sectional (OR: 0.84, 95% CI: 0.80, 0.87) and cohort (OR: 0.90, 95% CI: 0.85, 0.94) studies, and in the USA (OR: 0.92, 95% CI: 0.90, 0.95) and the UK (OR: 0.84, 95% CI: 0.83, 0.85), reduced the risk of RA and OA (Figures 3 and 4).

Increased LE8 scores in women (OR: 0.66, 95% CI: 0.54, 0.81) and men (OR: 0.67, 95% CI: 0.52, 0.86) reduced the risk of RA and OA (Figures 5 and 6).

Moderate LE8 levels compared with low levels (OR: 0.67, 95% CI: 0.60, 0.75) and high LE8 levels compared with low levels (OR: 0.50, 95% CI: 0.45, 0.54) reduced the risk of RA and OA (Figures 7 and 8).

Additional analysis

The meta-regression plot demonstrated that "the association between LE8 scores and the risk of RA and OA" and the number of samples in the included studies were not statistically significant (P = 0.774). Besides, the analysis indicated that studies with larger sample sizes did not report a stronger association between high LE8 scores and reduced risk of RA and OA (Figure 9).

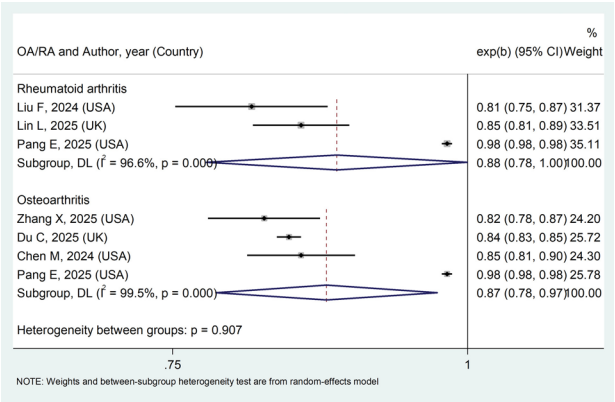

Figure 2. Forest plot showing the association between LE8 and rheumatoid arthritis and osteoarthritis.

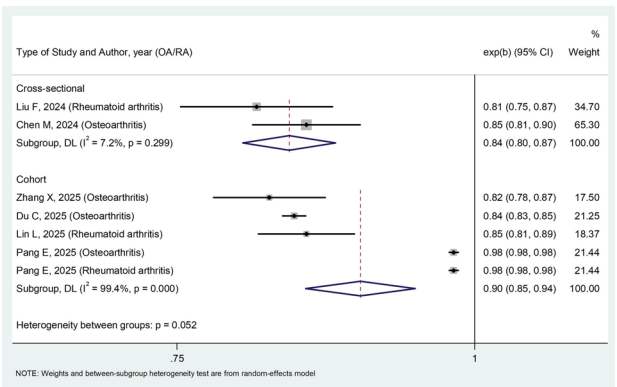

Figure 3. Forest plot showing the association between LE8 and rheumatoid arthritis and osteoarthritis by type of study.

Table 1. Summarized information of the studies

References	Country	Design	Time of study	Sample size	Mean age (year)	Compared with	OA/RA	Total score			Moderate score			High score		
								OR	Low limit	Up limit	OR	Low limit	Up limit	OR	Low limit	Up limit
Pang E, 2025 (20)	USA	Cohort	from 2005 to 2018	29324	46.71	Low Score	OA	0.98	0.98	0.99	0.75	0.67	0.74	0.44	0.35	0.54
Pang E, 2025 (20)	USA	Cohort	from 2005 to 2018	NR	NR	Low Score	RA	0.98	0.98	0.99	0.68	0.62	0.76	0.42	0.35	0.50
Lin L, 2025 (21)	UK	Cohort	between 2006 and 2010	247660	56.2	Low Score	RA	0.85	0.81	0.89	0.68	0.58	0.80	0.50	0.41	0.62
Du C, 2025 (22)	UK	Cohort	between 2006 and 2010	242278	55.56	Low Score	OA	0.84	0.83	0.85	0.77	0.73	0.81	0.56	0.52	0.60
Zhang X, 2025 (23)	USA	Cohort	from 2005 to 2018	21289	46.9	Low Score	OA	0.82	0.78	0.87	0.70	0.57	0.87	0.46	0.36	0.60
Mou D, 2025 (24)	USA	Cross-sectional	2007–2018	10231	56.99	Low Score	OA	NR	NR	NR	0.68	0.53	0.88	0.43	0.32	0.56
Wu L, 2025 (25)	USA	Cross-sectional	from 2005 to 2018	17943	46.1	Low Score	RA	NR	NR	NR	0.25	0.19	0.33	0.57	0.49	0.67
Liu F, 2024 (15)	USA	Cross-sectional	from 2007 to 2018	17263	44.85	Low Score	RA	0.81	0.75	0.87	0.68	0.53	0.87	0.36	0.23	0.55
Chen M, 2024 (26)	USA	Cross-sectional	from 2005 to 2018	8334	60.25	Low Score	OA	0.85	0.81	0.90	0.75	0.60	0.95	0.54	0.41	0.70
Gou R, 2023(27)	USA	Cross-sectional	1999–2019	23213	68.4	Low Score	OA	NR	NR	NR	0.81	0.69	0.96	0.55	0.44	0.69

OR: Odds ratio; NR: Not reported; OA: Osteoarthritis; RA: Rheumatoid arthritis.

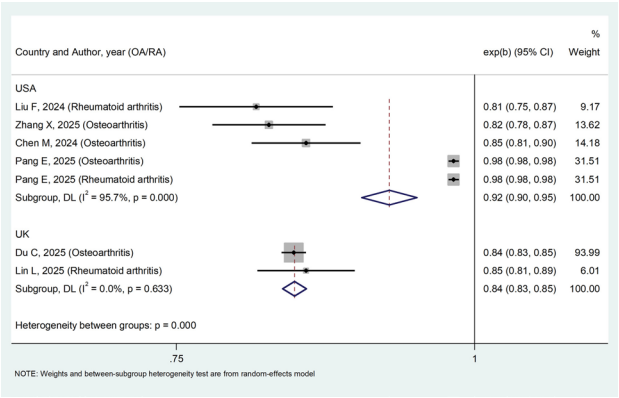

Figure 4. Forest plot showing the association between LE8 and rheumatoid arthritis and osteoarthritis by country.

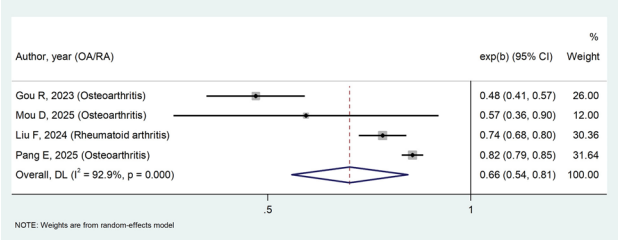

Figure 5. Forest plot showing the association between LE8 and rheumatoid arthritis and osteoarthritis in females.

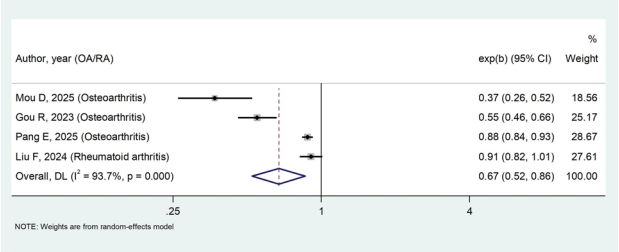

Figure 6. Forest plot showing the association between LE8 and rheumatoid arthritis and osteoarthritis in males.

Sensitivity analysis showed that studies (20) and (22) were the most influential in determining the final outcome of the current meta-analysis, and removing any of them significantly affected the results of the present meta-analysis (Figure 10).

Discussion

The current meta-analysis indicated that increased LE8 scores reduced the risk of RA and OA by 12% and 13%, respectively. Additionally, moderate LE8 scores compared with low levels reduced the risk of RA and OA by 33% while high LE8 scores reduced the risk by 50%. Furthermore, higher LE8 scores reduced the risk of RA and OA by 34% in women, by 33% in men, by 8% in the USA, and by 16% in the UK.

According to the results of a meta-analysis by Wu et al investigating the relationship between LE8 score and risk of RA, participants with moderate to higher LE8 scores,

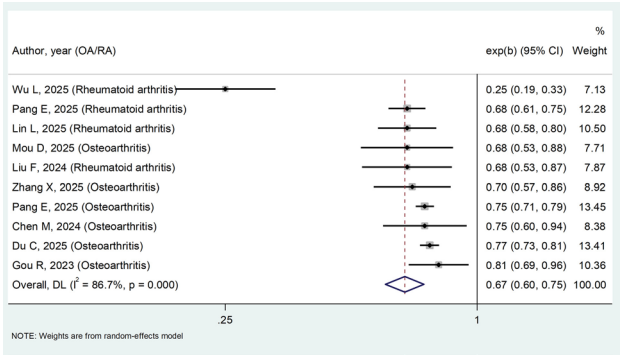

Figure 7. Forest plot showing the association between moderate level LE 8 and rheumatoid arthritis and osteoarthritis.

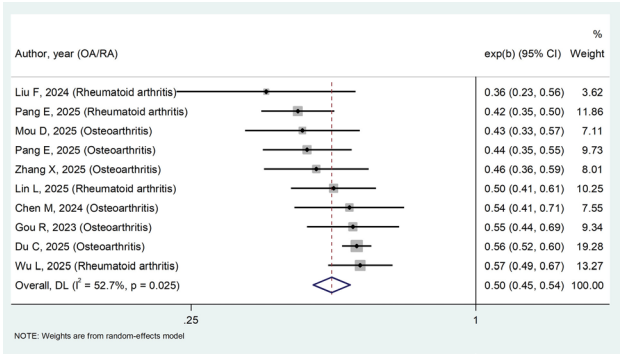

Figure 8. Forest plot showing the association between high level LE 8 and rheumatoid arthritis and osteoarthritis.

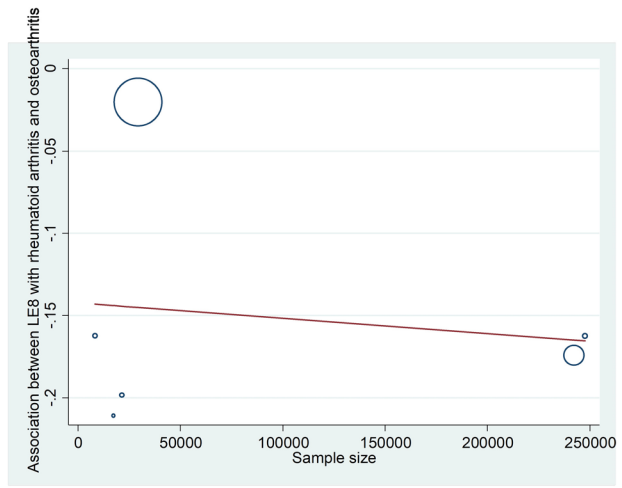

Figure 9. Meta-regression plot of association between LE 8 and rheumatoid arthritis and osteoarthritis.

compared with those with low levels, faced reduced risks of RA (25). The type and final outcome of this study were consistent with our study.

In a cross-sectional study by Liu et al examining the association between LE8 and chronic obstructive pulmonary disease (COPD), findings indicated an inverse association between LE8 scores and COPD (OR: 0.16, 95% CI: 0.11, 0.24) (28). In cross-sectional research on

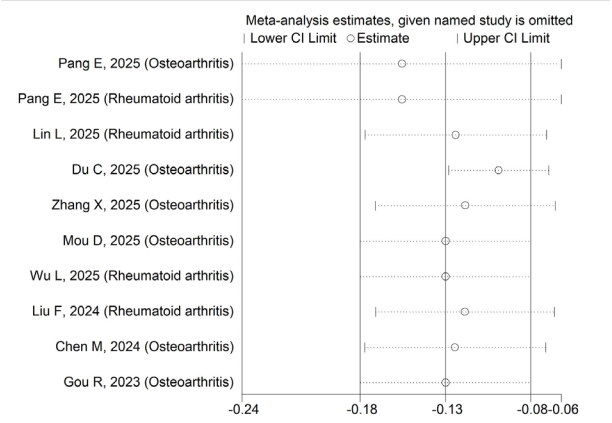

Figure 10. Sensitivity analysis.

20537 participants, Fen et al demonstrated that higher LE8 scores were associated with lower risk of chronic respiratory diseases in adults (OR: 0.77, 95% CI: 0.55, 0.92) (29). In another cross-sectional study by Zhang et al, results revealed a negative correlation between LE8 scores and risk of psoriasis in American adults (OR: 0.99, 95% CI: 0.98, 0.99) (30). According to the findings of a cross-sectional study by Wang et al, higher LE8 scores reduced the risk of diabetic retinopathy (OR: 0.24, 95% CI: 0.11, 0.50) (31). Liu et al conducted a study to examine the association between LE8 and RA, and reported that higher LE8 scores were closely associated with reduced risk of RA (OR: 0.81, 95% CI: 0.75, 0.87) (15). Based on the results of a cross-sectional study by Mou et al, the risk of OA in participants with moderate (OR: 0.68, 95% CI: 0.53, 0.88) or high (OR: 0.43, 95% CI: 0.32, 0.56) LE8 scores was significantly lower than those with low LE8 levels (24). In a cross-sectional study by Chen et al investigating the relationship between LE8 and risk of OA, findings showed that individuals with 10 points higher LE8 scores faced 15% lower risk of OA (OR: 0.85, 95% CI: 0.81, 0.90) (26). The mentioned studies were consistent with the current meta-analysis and demonstrated a negative correlation between the scores obtained from LE8 and the incidence of chronic respiratory diseases, COPD, OA, psoriasis, RA, and diabetic retinopathy.

In a cohort study by He et al on the association between LE8 and risk of arthritis in the American adults, findings indicated that higher LE8 scores were associated with lower risks of developing arthritis (for the group with moderate scores: OR: 0.83, 95% CI: 0.68, 1.00; for the group with high scores: OR: 0.72, 95% CI: 0.50, 1.02) (32). They concluded that the preventive effect of high LE8 scores on the risk of OA and RA was greater than that of moderate LE8 scores, which was consistent with the present meta-analysis.

Yang et al conducted a cohort study on 260836 participants and demonstrated an inverse association between LE8 scores and the risk of developing inflammatory bowel disease (HR: 0.67, 95% CI: 0.52, 0.83) (33). According to the results of a cohort study by Shi et al, participants with high LE8 scores indicated a 21% lower risk of cancer compared with those with low LE8 scores (HR: 0.79, 95% CI: 0.70, 0.90) (34). Findings of a cohort study by Ouyang et al showed that risks of developing psoriasis in individuals with moderate and high LE8 scores compared with those with low LE8 scores were (HR: 0.51, 95% CI: 0.43, 0.59) and (HR: 0.34, 95% CI: 0.27, 0.42), respectively (35). Zhang et al conducted research using cohort method and concluded that increased LE8 scores were associated with 17% lower risks of asthma (HR: 0.83, 95% CI: 0.81, 0.85) (36). In a cohort study, Pang et al screened 29324 participants and demonstrated that higher LE8 scores were associated with lower risks of OA (OR: 0.44, 95% CI, 0.35, 0.54) and RA (OR: 0.42, 95% CI, 0.35, 0.50) (20). In a cohort study by Du et al on the relationship between LE8 and genetic predisposition with the risk of OA, results showed a lower risk in participants with high LE8 scores compared with those with low scores (HR: 0.56, 95% CI: 0.52, 0.60) (22). These studies were consistent with our findings, as we concluded by combining cohort studies that moderate and high LE8 scores played a preventive role against OA and RA compared with lower LE8 scores.

Conclusion

Increased LE8 scores reduced the risk of RA and OA by 12% and 13%, respectively, and higher LE8 scores led to higher percentages of prevention against RA and OA. Furthermore, the association between increased LE8 scores and reduced risk of RA and OA indicated no significant difference between men and women.

Limitations of the study

This study faced limitations, which, considering the type of the study, were inevitable. Due to the limitation of the number of reviewed studies, conducting analyses on the association between increased LE8 scores and reduction in the risk of OA based on subgroups gender, study type, and LE8 score, was not possible. Similarly, it was not possible to analyze the connection between increased LE8 scores and reduced risk of RA based on subgroups gender, study type, and LE8 score. Therefore, a subgroup analysis was performed based on all the reviewed studies.

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Authors' contribution

Conceptualization: Farid Mirzaee and Pooyan Dehghani.
Data curation: Pooyan Dehghani, Mohammad Rostamzadeh and Sana Amiri.
Formal analysis: Reza Farzaneh and Abdolmohammad Ranjbar.
Investigation: Farid Mirzaee and Abdolmohammad Ranjbar.
Methodology: Reza Farzaneh and Amir Heidari.
Project administration: Pooyan Dehghani.

Supervision: All authors.
Validation: Amir Heidari and Ali Darabi.
Visualization: Ali Darabi and Sana Amiri.
Writing–original draft: All authors.
Writing–review and editing: All authors.

Conflicts of interest

The authors declare that they have no competing interests.

Declaration of generative artificial intelligence (AI) and AI-assisted technologies in the writing process

During the preparation of this work, the authors utilized AI tools (Copilot [https://copilot.microsoft.com/] and Grammarly.com) to refine grammatical points and language style in their writing. Subsequently, the authors thoroughly reviewed and edited the content as necessary, assuming full responsibility for the accuracy and content of the publication.

Ethical issues

This study has been compiled based on the PRISMA checklist, and its protocol was registered on the PROSPERO website (ID: CRD420261376295) and the Research Registry website with (Unique Identifying Number [UIN]: reviewregistry2097). Besides, ethical issues (including plagiarism, data fabrication, and double publication) have been completely observed by the author.

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